TV & Video • Hifi • Computers • Auto Electronics

SONY'S NEW SUPER-FLAT SCREEN TRINITRON TV

NDD

MAY 1998

Electronics Australia

with PROFESSIONAL ELECTRONICS & ETI

The US Military's HAARP: Research Tool or Death Star?

Kodak's new $25,450 'Pro' digital camera

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You can easily install this alarm system yourself. It has PIR (Passive Infrared) sensors with coverage of 45 feet in an arc of 110 degrees, a user-programmable security code and a 110dB Piezo siren. Provides 4 zones and has 7 LED indicators.

L 5730

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SCOOP PURCHASE

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Easy D.I.Y installation with user programmable security code, this system also has a terminal connector for the addition of other sensors. It provides 3 zones, 7 LED indicators, a built-in PIR sensor covering 45 feet in an arc of 110 degrees and a 110dB Piezo siren.

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The latest in car alarms and it's Australian-made! Features microprocessor-controlled rolling code technology, anti-scanning, anti-code grabbing with a personal panic button and red flashing LED light. Includes a two-function remote control and a five-year warranty.

L 5417

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Protect your Car with this Remote Control Car Alarm

Includes two remote controls, central locking interface and pre-warn shock sensor as well as microprocessor-controlled rolling code technology, anti-scanning, anti-code grabbing with a personal panic button and red flashing LED light plus more!

L 5418

$199 SAVE **$50** Rhino

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Use this hidden security camera disguised as a clock to watch your premises. Connect to a monitor or VCR. Great for the home or small business, this round Citizen wall clock is 130mm in diameter with an inbuilt black and white PCB camera.

L 5840

$229

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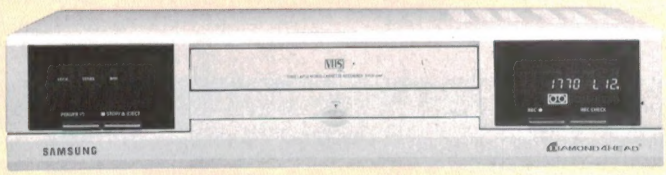

Affordable Security VCR*

Finally - a time lapse VCR at an excellent price. Features CCTV connection, time lapse shots, recording when PIR sensors are triggered, recording/playback speeds 2 to 24 hours with time, date and alarm on screen, electronic buzzer alarm up to 30 minutes. Four-head VCR measures 430 x 90.5 x 315mm.

L 5845

SAMSUNG **$999**

*Limited Stores

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May 1998 Volume 60, No. 5

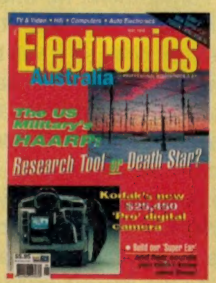
World of Electronics

Projects and Technical

Columns and Comments

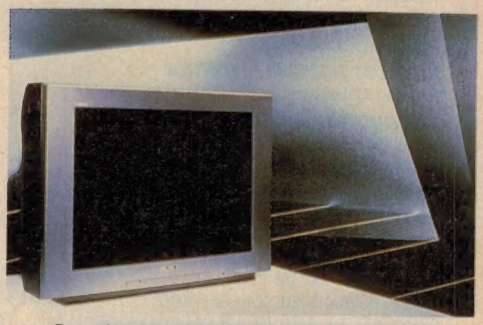
Departments

On the cover



Deep in the frozen forests of Alaska, the US military has built a huge array of antennas and transmitters, which they say is to conduct ionospheric research. But there are fears that HAARP could have more worrying uses, as Tom Moffat explains in his feature story (page 14). For more on Kodak's impressive new DCS 520 Pro camera see page 6.

Sony's new Trinitron



10 ***Sony's new Wega colour TV uses its super-flat screen 29" FD Trinitron — and the picture quality is superb, according to Louis Challis***

More pixels, fewer dollars

6 ***Kodak's new DC200 digital camera offers 1152 x 864 pixel resolution plus a 1.8" LCD — for only $1250***

More on those gadgets

28 ***In Forum this month we take a look at some more of those alternative electrotherapy gizmos, like Dr Beck's magnetic pulser***

Professional Electronics

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Letters to the Editor

Fuseholder danger

Just a quick note about the 'Four in One' power supply described in the January '98 issue. The mains fuseholder on the rear panel appears to be of the 'non-approved' type. This can be quite dangerous if someone opens the holder while the unit is plugged in. You mention this in the text but if the fuse is intact, it's still got 240V on the end of it.

A better solution would be an approved type where you can't stick your fingers in it, or just use a combined IEC socket/fuseholder which prevents fuse removal without unplugging the IEC lead. These are quite cheap/common and mean that there is less wiring and no fuseholder hole to drill.

Also, the power transformer should be mounted with a nut above AND below the frame, to ensure the earth contact is not lost if the transformer heats up and melts the plastic case. A diagram of this in each 240V AC project article would be helpful. Apart from that, keep up the good work!

Dave Duffy, Cleveland, Qld.

Amiga DOS

In Tom Moffat's Madhouse (February 1998), he writes a thoughtful and interesting column — as always. Unfortunately, he erred on one point when he was discussing an alternative to Windows: *Yet another message suggests something like AmigaDos. Now there was a computer that put a lot of present designs to shame. The Amiga was a clean, slick, technical marvel. But it was badly managed, badly marketed, and eventually it bit the dust.*

He goes on to say that he bought an Amiga 500 *primarily to develop Amiga versions of my Listening Post weatherfax and satellite software. It was a floppy-only machine, and I had various disks set up to boot either to AmigaDos or to its graphics mode, depending on what the disk was used for. It was very civilised.*

Well, much as I found his article an interesting read, he is dead wrong in a couple of places here. The Amiga is alive and well and living in America, under the roof of some mob called Gateway 2000.

The old Amiga 500, along with the IBM XT has indeed bitten the dust, but I subscribe to several American and British Amiga-specific magazines, and I read that new products are out there in great heaps. The irrepressible Mr Moffat, or your readers, might like to point their browsers at **http://www.weirdscience.co.uk**, or **www.cucug.org** for all the latest news on the latest hardware and software, including browsers suitable for just such a machine as he has in mind.

In fact, why could Tom not suggest such an approach to Gateway 2000's subsidiary, Amiga Technologies? Personally, I own both an old DEC 486 computer running Microsoft Windows 3.11, and an Amiga 2500 with a graphics card, which runs Amiga Dos 3.1. I much prefer the Amiga, it's faster and more stable.

Euan Miller (address not supplied)

Rotation: yes!

I read with interest the letter entitled 'No Rotation!' (page 4, March 1998) from J. Johansen of Noranda, WA in which he disagrees with my suggestion to rotate the output sockets on the Christmas lights controller.

I have had a look at AS3000, which he quoted as the 'relevant regulation', but fail to see its relevance here. AS3000 is entitled 'Electrical installations — Buildings, structures and premises (known as the SAA Wiring Rules)' and is plainly relevant only to installations in buildings, etc. — i.e., places where the wiring must be done by a licensed electrician.

The project in question, however, does not come under those regulations as it is a stand-alone unit which simply plugs into the mains. I.e., it is an appliance.

Furthermore, he writes about the Earth pin being longer than the Active and Neutral pins, so it will break last (agreed) and then goes on to say that when mounted on an angle the Active could easily break last. I cannot see how the Active pin on the plug is suddenly going to change its length by the socket being rotated 45 degrees. To me that seems to be a physical impossibility.

As the project could end up being placed at any angle when being used, I believe that his arguments are totally irrelevant.

BTW, I have made, in the past, a stage switch box for switching various electrical

devices around a live stage from a central point. It uses a low voltage control line to the control box at the Stage Manager's desk, with the main unit out of the way up on a gantry. It runs across three phases with seven outlets along each of three sides of the box, with all the sockets mounted as I originally suggested. This unit was inspected before it could be used on stage and was passed as meeting all relevant requirements.

Eric van de Weyer, VK2KUR (by e-mail)

Electrotherapies

Just a message of support for your stand on the subject of electrotherapy devices. Like you I was surprised at your reported response to the subject.

What is going on here? I would have thought readers of *EA* would be sane and rational people! I suppose what we are seeing is a disproportionate response from a fanatical minority of believers in snake oil (the electronic type).

I have a good friend with scientific training whose response to any injury is to strap a magnet on the offending region. If you can see any logic in that, let me know!

I'm sure there are plenty out here that are capable of logical science-based reasoning. Keep up the good work.

John Duruz (via e-mail).

Bogus health devices

I write to congratulate you on Jim Rowe's articles in the January and February Forum. It is about time a reputable magazine exposed these charlatans. To prey on the sick and the dying, who often are so desperate they will try any advertised cure, is despicable. And the fact that your correspondent Cheryl has received threats for her efforts tells us the sort of people who market these products.

When is the Department of Consumer Affairs going to do the job our taxes pay it to do?

Richard Lead, Pymble NSW.

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We welcome contributions to this column, but reserve the right to edit letters which are very long or potentially defamatory.

Editorial Viewpoint

Digital TV: it might be worth waiting until the dust clears...

It's been interesting to note the developments that have taken place both here and overseas, since I wrote last month's leader commenting on digital TV. Not that any of these developments were a consequence of what *I* wrote, of course — it's just that this is an area where the technology is developing fast, there are big players involved and there's a lot of money at stake.

In many ways what's happening in Australia seems to be a kind of microcosm of the global situation. Take the fierce debate about providing free second channels to terrestrial broadcasters, for example. The broadcasters understandably want this, because they're going to have to outlay a lot of money to swing over to digital, yet they will need to continue broadcasting in analog for many years until most viewers have replaced their analog sets (or at least purchased set-top boxes). It's not unreasonable to expect licence-free use of the second channel for a reasonable number of years, as America's FCC seems to have agreed. After all, maintaining the parallel analog service is very much in the interests of the viewers as well...

Yet the Pay-TV, information service providers and other media are very concerned at the TV networks getting such a 'free kick', because they see that this could easily allow the broadcasters to gain an unfair advantage in terms of additional channels with which to provide subscription data services, internet access, online merchandising and so on. At the very least *they'd* like to see the broadcasters forced to use the extra channels *only* for high-definition digital TV; yet that's just what the broadcasters *don't* want, because they know that for the first few years, the number of viewers who'll be able and prepared to buy a digital HDTV receiver will be very small.

In fact it's probably in the best interests of viewers to keep the options open too, because many viewers who won't be able to afford a full digital HDTV may well be able to afford a set-top digital decoder, and watch lower-res digital.

Then there's the matter of digital encoding formats, and the exact technical standards that are going to be used to deliver digital video, whether it be via terrestrial broadcasting, satellite, cable, internet or whatever. The technology is still in development, and we could easily end up with a number of either incompatible, or only partly compatible systems — with consumers expected to buy (or rent) multiple set-top boxes if they want to receive more than one. And judging from the past, if that does happen some of the initial systems would probably soon be eclipsed by others, and the corresponding boxes made prematurely obsolete...

As the British magazine *Which?* recently advised its subscribers, those who rush into buying digital TV receivers or set-top boxes could easily end up being caught. It's one of those situations where even though we all *know* the move to digital is inevitable and will ultimately bring many benefits, it would still be wise to wait until the dust clears before actually outlaying your money.

That old Russian curse along the lines 'May you live in interesting times' seems rather appropriate, doesn't it?

Jim Rowe

WHAT'S new

in the ever-changing world of electronics

Flexible five-channel surround sound amp

Madrigal Audio Laboratories' new Citation System 5000 AV surround audio system incorporates a Six-Axis decoding system which is claimed to reproduce a near discrete multi-channel surround experience from all audio and video source material, including non-Dolby encoded music programs. The controller also delivers outstanding video switching and distribution.

Citation's new high end multi-channel system consists of the new 5.0 AAV Controller, three 5.1 high-current, multi-channel amplifiers and a loudspeaker complement consisting of three LCR speakers, a pair of 5.3 Dual Drive Dipole Surround Speakers and two 5.4 Subwoofers.

Designed by the renowned Jim Fosgate, Six-Axis processing uses ultra fast steering logic and patented circuitry to create a seamless and totally enveloping sound field. Patented Dual Drive Dipole technology is engaged when the 5.0 AV Controller is used in conjunction with the Citation 5.3 Dipole Loudspeakers. The system can be configured for both diffuse surround for Dolby ProLogic or Point Source surround for both movie and music sources.

The Citation System 5000 is available worldwide at selected audio/video specialty retailers. The manufacturer's RRP for the new 5.0 AV Controller is US$7650.

New JBL speakers

Convoy International, exclusive local distributor for the consumer and car audio products of US loudspeaker maker JBL, has announced the introduction of JBL's new HLS Series of horn-loaded speakers. The new line is claimed as most innovative.

The HLS Series consists of two bookshelf models, three floor-standing models and an acoustically matched centre channel for home cinema applications. The speakers combine a proprietary JBL constant directivity high-frequency horn with heavy-duty low frequency transducers, in enclosures optimised to deliver accurate stereo imaging in any listening environment, at any listening level. The low frequency transducers employ co-injection moulded polypropylene cones which quickly respond to changing input signals while maintaining their shape at all times.

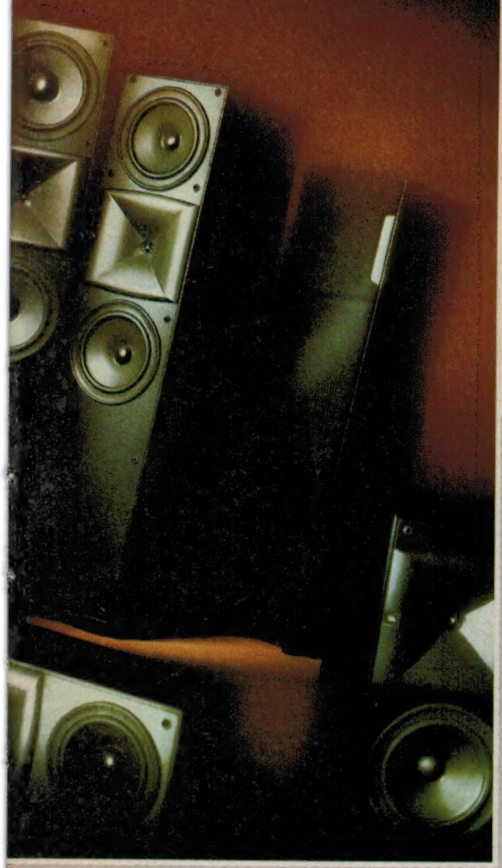
Every model in the HLS series is Dolby Digital compatible, provided

Kodak's new DCS 520 'pro' digital camera

Designed by Kodak to be the leading professional digital camera in the world today, the new DCS 520 is claimed to mark a breakthrough in the digital photography market by incorporating more than 30 key patented technology innovations.

Kodak's first fully integrated digital single lens reflex (SLR) camera, the DCS 520 is based on a Canon EOS1 camera subsystem, uses a 1168 x 1728 pixel CCD sensor and saves images in 36-bit format (12 bits per colour per pixel). It captures images at a burst rate of 3.5 frames/second, and is able to buffer 12 frames before downloading to disk. A calibrated TTL flash ensures proper flash exposure. The camera has dual PCMCIA slots (type I, II, III), an IEEE 1394 high speed serial interface and a colour LCD for image analysis. Removable and rechargeable NiCad battery packs allow up to 300 shots per charge.

There's no doubt that the DCS 520 is intended for professionals rather than amateur photographers, though — list price is a cool $25,450.

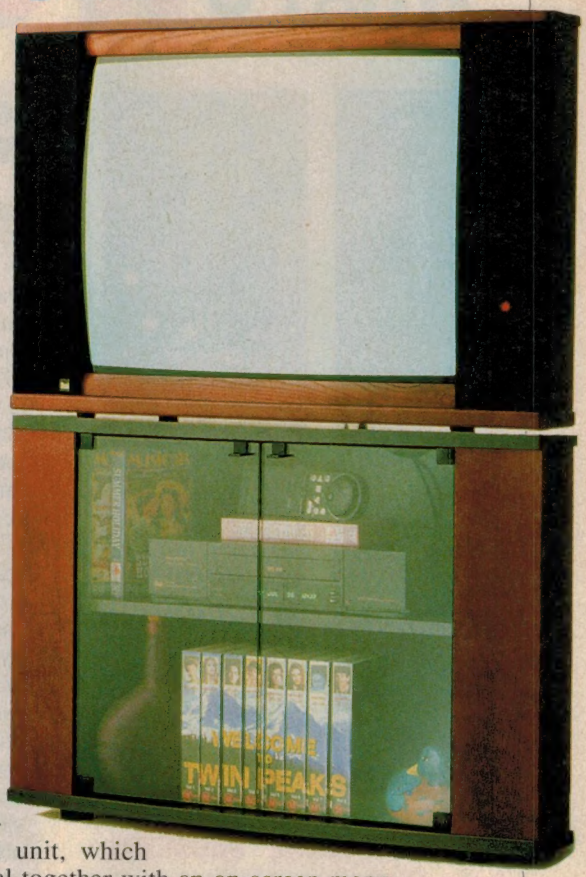


with five-way binding posts for maximum hookup flexibility and video-shielded for placement near a TV receiver. The HLS series is finished in a handsome black brushed satin, enabling the loudspeakers to easily integrate into any environment.

Suggested RRPs range from $699/pair for the HLS610 entry-level bookshelf speakers to $1699/pair for the top-of-the-line, floor-standing HLS820. The centre channel unit carries a list price of $499/each.

For more information circle **141** on the reader service card or contact Convoy International on (02) 9700 0111.

Luxury CTVs feature genuine wood cabinets



Respected German turntable manufacturer DUAL, which has also been making TV receivers for many years, has released a new range of luxury CTV receivers with a novel feature by today's standards: genuine timber cabinets, made from either mahogany or oak. A matching stand/cabinet, also in mahogany or oak timber finish, is available as an option to house a VCR and other accessories.

The new models, known as the 'Classique Range', also feature high-power speaker systems running down either side of the sets and dressed in a complementary black cloth.

The sets feature a soft and very 'natural' picture. Featuring the high performance 'Blackline S' picture tube, each set delivers sharp, true-to-life images with rich but natural colour. All signals are processed in the digital domain, preventing signal degradation. Multi-standard capability and teletext are both standard.

All three sets feature the 'Joy-Jog' super-simple remote control unit, which uses only six buttons and a jog dial together with an on-screen menu to make it a pleasure to use. The Classique range is part of a complete line-up of Dual televisions consisting of nine models, ranging in price from $1699 up to the 85cm set at $3499.

For more information circle **151** on the reader service card or contact distributor Scan Audio, 52 Crown Street, Richmond 3121.

New Technics micro hifi system

Panasonic has launched a new Technics micro hifi system (Model SC-HD70), designed for people who want a stylish compact stereo system with excellent sound output. The system's centre unit has a silver finish rather than the standard black or grey of many systems, while the speakers have a woodgrain finish.

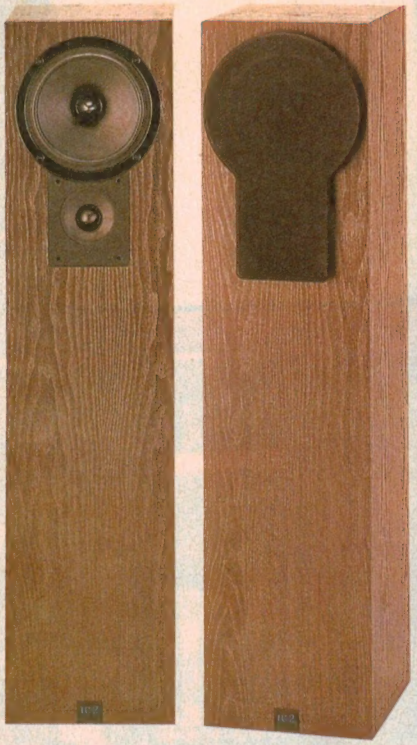
Despite its compact size (each component is only 196mm wide) the system has a five-CD changer with high speed disc change and access. It includes Technics' single-bit 'MASH' conversion and Digital Servo technology for clear CD sound.

The compact woodgrain speakers deliver a rated power output of 60W x 2 (RMS) and include a 120mm woofer.

The SC-HD70 also includes a horizontal-loading single auto-reverse tape deck and an FM/AM digital tuner. It's available from leading electrical retailers for an RRP of $1658.

For more information contact Panasonic's Customer Care Centre on 132 600.

WHAT'S new in the ever-changing world of electronics



More 'European' speakers from Pioneer

Pioneer has expanded its range of 'European' speaker systems, featuring a neutral mid-range, flatter bass and an extended treble.

Both the bookshelf S-LC1 and the floor-standing S-LC2 are network-free, two-way speaker systems with a direct drive woofer in a bass reflex enclosure. The simplified crossover system is claimed to minimise sound degradation. The systems also position the woofer above the tweeter, so sound from the woofer and tweeter 'arrives at your ears simultaneously'.

Both systems incorporate a 180mm woofer with diffuser and a 25mm dome tweeter with asymmetrical round flange. The S-LC2 also uses a reflection board-design to protect against standing wave inside the speaker box. Both speakers have a 100W music power rating.

The S-LC1 and S-LC2 are available at Pioneer dealers throughout Australia and New Zealand and have an RRP of $799 and $1199 respectively. For more information circle **142** on the reader service card or contact Pioneer Electronics Australia, PO Box 295, Mordialloc 3195.

Lower priced Kodak 'Megapixel' digital camera

Kodak has expanded its popular family of point-and-shoot digital with its third — and lowest priced — digital camera featuring megapixel (million pixels per image) image quality. The new DC200 camera has an estimated street price of $1250, and features a built-in automatic flash, a 1.8" colour liquid crystal display (LCD) and a 1152 x 864 pixel progressive scan image sensor. The lens is threaded to accept standard-mount accessory lenses.

The DC200 also offers a number of features originally offered with the Kodak Digital Science DC210 zoom camera, including 'finished file' capability (Direct FlashPix or JPG) which enables easy transfer of pictures from the camera to the computer; TV/video output capability (NTSC or PAL video formats) which provides easy review of pictures though a video monitor or television; and a 4MB CompactFlash removable memory card, included with the camera, which stores up to 60 pictures.

The DC200 camera ships with a package of easy-to-use software for Windows 95 and NT4.0.

For more information circle 146 on the reader service card or contact Kodak on 1800 674 831.

Professional CD recorder

The new Otari CDR-18 Professional Compact Disc Recorder is claimed to deliver all of Otari's well known performance and reliability in a cost-effective, stand alone package for writing CDs from virtually any analog or digital source.

Single-bit A/D converters are used to minimise zero crossing distortion and reduce nonlinear distortion across the entire frequency range. In addition, improved channel separation and level linearity has been achieved by Otari's use of Shortest Signal Path design as well as careful separation of the internal digital and analog circuitry. Another major feature is the provision of an on-board Sample Rate Converter, which automatically con-

Compact plain paper fax has seven functions

Panasonic has launched a new compact multi-function plain paper facsimile machine (KX-F1110AL) that is capable of performing seven different functions — fax, PC printer, PC scanner, PC fax, copier function, phone and digital answering machine — all built-in as standard. The unit also has a 14.4k modem, which is faster than previous models and can save money on STD and overseas transmissions.

The KX-F1110AL has a 28-page memory, which can either store incoming information when the paper is exhausted, or hold outgoing information for transmission at a later time. It also has a phone handset and a digital (duplex) hands-free speakerphone so the user can still use

verts digital material from sources such as 48kHz DAT, broadcast satellites, DVD etc., to the standard 44.1kHz CD sample rate.

To ensure maximum stability and minimum vibration interference during recording and playback, the CDR-18 also incorporates a turntable-type disc drive mechanism to provide complete support over the entire disc surface.

It features two types of analog inputs — balanced XLR (switchable +4dBu/-8dBu) and RCA pin-type inputs — plus RCA analog outputs. Three types of digital inputs are available: AES/EBU (XLR), IEC958 (coaxial type) and optical connectors. Digital output is via either IEC958 coaxial or optical connectors.

For more information circle **149** on the reader service card or contact distributor Amber Technology, Unit B, 5 Skyline Place, Frenchs Forest 2086.

Car power amp has 1200W of grunt

To satisfy the quest for more power and flexibility from car amplifiers, Kenwood has created the new PS Series of amplifiers featuring a strengthened 'Double Power' design. Top of this new line is the KAC-PS400M mono power amplifier, which produces an enormous 1200W maximum power, with superior stability and improved control of subwoofers.

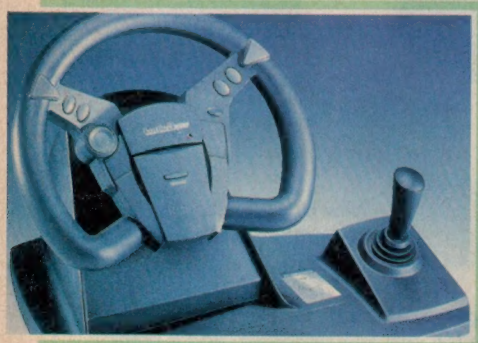
To achieve this output power in a car amplifier Kenwood adapted its Sigma Drive Servo System technology. This extends the negative feedback loop to include the speaker cable, enabling direct and accurate control of speaker EMF and hence more faithful reproduction.

The high power of the KAC-PS400M is matched by the flexible operation of its power supply, which switches the output supply rails to suit

power requirements. This enables larger power output while reducing heat radiation and mutual interference. Two variable speed cooling fans help keep operating temperatures to a minimum, preserving crucial driver and output components.

Special variable band-reject filtering prevents interaction when the amplifier is used to drive a subwoofer. The KAC-PS400M is also provided with a 2Ω tapping to drive low impedance speaker loads.

With an RRP of $1099, the KAC-PS400M is available at selected Kenwood car audio specialists. For more information circle **144** on the reader service card or contact Kenwood Electronics Australia. ❖



Wheel for PC gamers

Based on the award winning Tri-format TopGear Wheel, already proving a huge success with N64 and PlayStation players, SpectraVideo's PC TopDrive makes the same technology available to all PC users. Described as the 'world's most advanced PC wheel' the steering controller comes packed with features, including self-centring technology, six fire buttons and an eight-way D pad.

A novel programmable steering rotation system provides the user with complete flexibility in reaction response, and the Wheel itself has a removable leatherette cover for enhanced grip and realistic feel.

Effective wheel gearing can be selected as either 1:1 or 1:2, which is said to improve steering control on tight corners.

The PC TopDrive comes complete with a Stick Shift and spring loaded racing Pedals (accelerator and brake) — making it very suitable for use with the growing number of PC-based racing games. The quoted price in the UK is £59.95

For more information circle **143** on the reader service card or contact SpectraVideo, Unit 27, Northfield Industrial Estate, Beresford Avenue, Wembley HA0 1NW, UK.

their hands and speak on the phone. In addition there's an integrated digital telephone answering facility, where both the outgoing and incoming messages are recorded digitally.

Although it uses thermal transfer printing technology, the new machine uses A4-size plain paper, as used in a photocopier. It therefore is readily available, easier to write on, won't curl and doesn't fade.

The KX-F 1110AL has 64-level halftones, copier function, 18 one-touch memory and 100 additional memory positions, automatic redial and is compatible with Telstra's Faxstream-Duet service. It carries an RRP of $999.

For more information circle **145** on the reader service card or contact Panasonic's Customer Care Centre on 132 600.

Sony's FD Trinitron Wega flat-screen CTV

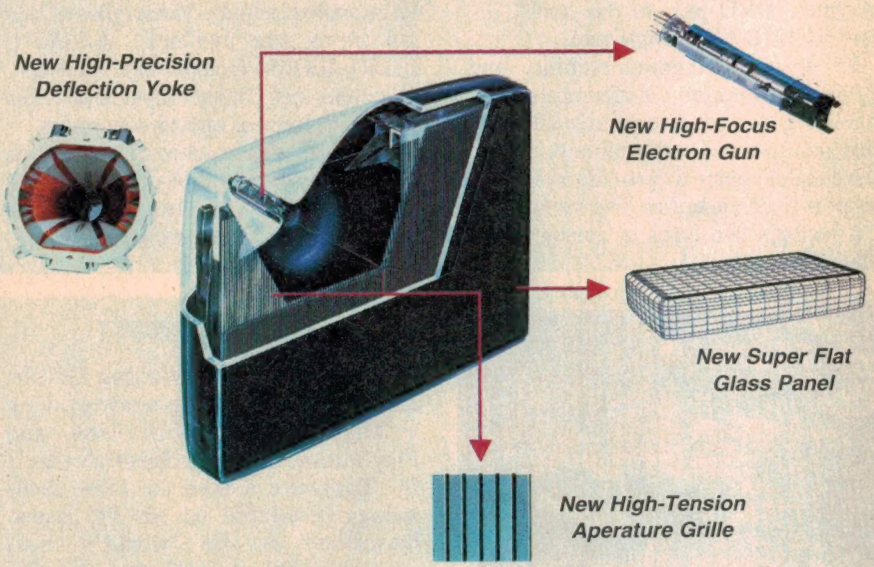
This month our reviewer Louis Challis has been trying out the new Sony KV-EF29 'Wega' colour TV receiver, featuring the new FD (flat display) Trinitron technology coupled with a host of other refinements. The picture quality almost blew him away...

Sony released its new Wega (pronounced 'Vay-ga') range of flat display or 'FD' television sets in Japan in 1997. The timing was most auspicious, as Sony claims that 1997 was the centenary of Braun's pioneering development of the 'original cathode-ray tube' in Germany. Frankly, although Sony has recently made me aware of Braun's work, my reference books place much more emphasis on the work carried out by others. Possibly the most important researcher of that period was Geissler. His vacuum tube, which incorporated high voltage electrodes, was the most fundamental development in the long and complex saga leading to the development of the modern cathode-ray tube (CRT).

Although Sony's PR organisation truly believes that they were the first to manufacture and develop a (nominally) flat-faced CRT, that claim may not be strictly correct. The original developer of the flat faced CRT was an extremely young American named Phil Farnsworth, who understood the importance of a 'flat faced' tube. So in the latter half of 1928, ably assisted by his glass blower Cliff Gardner, they achieved what was then generally viewed as being impossible. They fabricated a CRT incorporating what they regarded as being a perfectly flat face, coated with phosphor to make the world's first fully electronic television system.

Whilst Sony's PR releases acknowledge the pioneering research work of Zworykin's and other distinguished researchers' work at RCA's Camden facility in the later half of the 1930s, I was intrigued to find that they are apparently oblivious to Phil Farnsworth's outstanding work in CRT developments, precisely 70 years ago. Phil held the patents which his competitors were forced to licence.

Between 1928 and 1968 there were other numerous outstanding TV developments. The year 1968 was however an important year for Sony, as that was the year in which Sony developed its famous Trinitron technology. That was, and still is, a 'state-of-the-art' advancement in CRT technology — no arguments.



At the heart of the new FD Trinitron technology are four key developments: a super-flat screen, made possible by computer-aided design and new materials; and a high-tension aperture grille, a high-precision yoke and an improved electron gun.

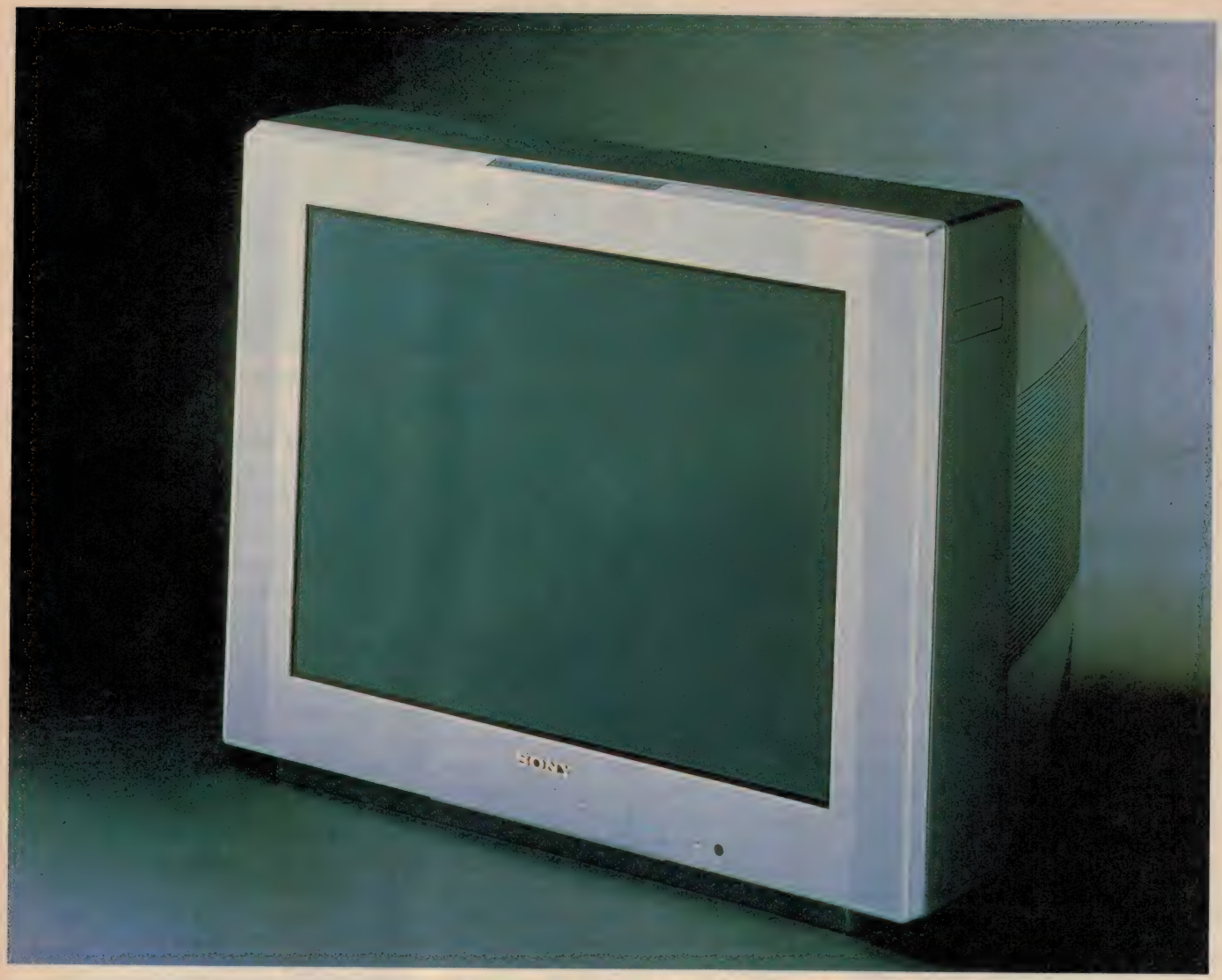
Over the last 30 years, Sony's Trinitrons have shouldered aside most of their competition on the basis of superior performance. Trinitrons are now the preferred tubes for monitors in most television stations. More recently, they have become the preferred display tube in computer aided drafting (CAD) systems, and in other equally demanding tasks involving high quality monitors.

Whilst Sony's early colour Trinitron tubes offered a level of performance which was superior to most of their competitors, they lacked the degree of perfection that only a flat-faced tube can provide. Their vertical linearity was excellent, but their horizontal linearity failed to achieve the same high standards.

The new Sony FD Trinitron technology has been developed to obviate those specific deficiencies. It incorporates a *super-flat* glass face panel, which has sufficient thickness (and a corresponding minor increase in weight) to overcome the daunting problems of structural distortion associated with the changes in ambient air pressure which occur during the cooling process.

In order for the FD Trinitron to achieve its superior performance, the new flat screen is matched by a high tension aperture grille with a finer centre pitch structure than its predecessors. This ensures that the electron beam hits the correct spot on the phosphor coating and avoids the 'colour spill' which plagues so many of Sony's competitors.

The heart of the FD Trinitron system is its high focus electron gun. Sony claims that this provides a 20% improvement in cross angle sensitivity, as a result of its beam spot size being 30% smaller than that of its predecessor — and says that this achieves a crisper, sharper and more precise image. Frankly, having seen the results I can now support that statement.



Improved electronics

Of course an improved picture tube would by itself achieve little without the support of other electronic advances.

The FD Wega range incorporates some notable advances. Foremost amongst these are the improvements it has achieved in deflection yoke technology. The improved deflection yoke definitely reduces the extent of colour aberration, as well as reducing picture distortion around the edges of the screen. Sony's claims in this regard are readily confirmed using appropriate test hardware and software.

Sony claims that its Power VM Circuitry enhances the ratio of dark to light areas, shadows and detail through an increase in the circuitry's effective bandwidth. The Vertical Aperture Controller interacts with the Power VM circuitry to enhance the achievable detail around the vertical edges of an image, and again this was also readily confirmed using special software which I had collected for the purpose.

Tools for testing...

In order to evaluate Sony's claims, and particularly those relating to subtle differences in colour and picture quality, I used both old and new software. The old software was the Video Standard laserdisc, and specifically the Checkerboard, Crosshatch, Indian Head and Multiburst geometry patterns.

Those test patterns were supported by the matching patterns on Delos' *DVD Spectacular* test disc (DV 7001). The most telling of those patterns was the Modulated Gray Scale Multiburst pattern.

Surprisingly there were differences between the laserdisc and the DVD checkerboard patterns. The digitally derived software had a distinct edge over the analog-based test signals. But irrespective of which source data I used, there was no denying that the FD Trinitron technology was infinitely superior to the previous curved-screen Trinitron, particularly at the outermost corners and at the edges of the screen. The test patterns were absolutely square, and they displayed an uncompromising linearity. The manufacturer's claims of superior linearity were clearly justified.

The addition of a new generation of digital comb filtering further minimises dot-crawl distortion, and resulted in significant differences in accurate separation of luminance and colour signals. I used a number of chroma patterns and colour bars to assess the display brightness and its colour rendition. The adoption of a new Kirara Colour Phosphor provides a broader and enhanced colour range, which must certainly achieve a far more natural picture.

There are other claimed improvements such as the Intelligent Picture Noise Cancellation system, which Sony claims reduces fuzziness and visual specs on the screen in the presence of a weak input signal. I didn't have the appropriate hardware or software to directly evaluate this claim. I did however try using the TV set with an indoor rabbit's ear antenna in a well screened house with a very poor signal strength. Low and behold, even Channel 28 was displayed and

the noise suppression was remarkably good.

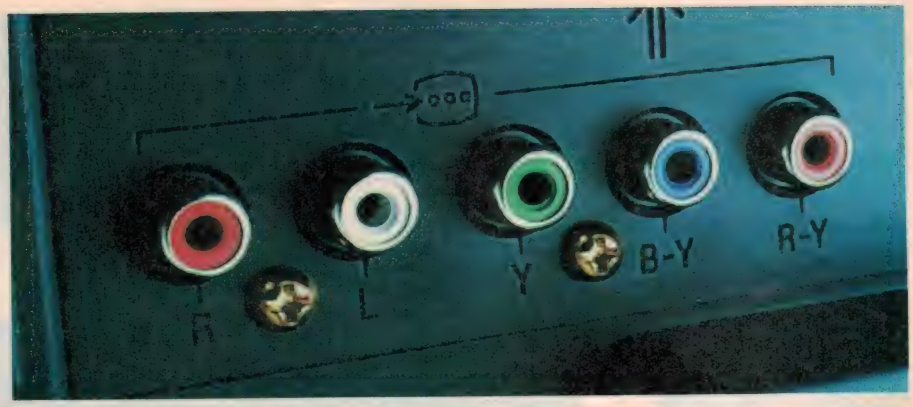
Sony's top of the line DVD players, which are about to be released in Australia and New Zealand, will provide the option of digital component colour signal output. The EF29 becomes the first Sony TV to offer dedicated DVD terminals to accept these signals. It also provides a terminal for composite signals and an S-Video socket. When fed with the digital component colour signals, you will achieve superior colour images with significantly enhanced clarity.

The EF29 provides other attractive features, including Mega Picture-in-Picture (PIP). This feature provides the means to view a main program as the full screen image, while from one to nine separate smaller screens can be simultaneously displayed on the screen. With that comprehensive viewing capability available to you, and although you are able to instantly select and enlarge the source or your choice for fullscreen viewing, I think it's unlikely that many viewers will use this feature frequently, if at all.

Quality sound, too

With the EF29 Sony has not ignored the equally important sound quality issue. It incorporates two separate nine-litre bass reflex speaker enclosures, one on each side of the cabinet. Each of those enclosures is powered by its own 15 watt amplifier, which provides a genuine 105dB peak output capability over the frequency range 60Hz to 16kHz, when measured 2.5m from the screen in my living room.

A significant number, if not the majority of people who purchase an EF29 TV will not necessarily supplement it by a full 5.1 channel Dolby digital sound system. The EF29's designers have made due allowance for those people and have provided a Virtual Dolby Surround system employing just the two internal speaker systems. In addition, the EF29 TV incorporates supplementary electronics through which the two speakers appropriately replicate the ambient and background sound fields, to provide a nominally seamless audio field in your living room.



The KV-EF29 receiver is also the first to provide direct inputs for digital component video, as well as analog composite and S-Video.

A 'Power Basso' button on the remote control increases the low frequency output, whilst simultaneously modifying the upper audible spectrum to create what Sony describes as a 'richer and unbelievably dynamic three-dimensional audio experience'. Whilst this is useful when listening to rock music, it has only limited advantage for conventional TV programs.

As if that weren't enough, Sony has integrated the SRS Laboratories' 'Trusurround system', which modifies the audio signal's spectral output to recreate the spatial cues that you employ to identify the location of a sound in a wide sound stage. In addition, you have a choice of five Hyper Surround choice modes — depending on whether you wish to listen to music, a cinema quality movie, an enlarged space, a music hall, or simply to the news.

The EF29's functional controls have adopted significant improvements when compared with previous Sony TV sets. First and foremost is the adoption of a new RM881 multi-player remote commander, which allows you to control your various items of audio/video equipment including DVD player, VCR, multi-disc player and mini-disc player — irrespective of the brand. The remote commander also features luminous buttons, which facilitates channel selection even in dim light.

The acid test

An important test for any TV set or monitor is to feed it with appropriate software and compare its performance against a known reference. I did this by comparing the video output of the EF29 against that from a Sony Profeel monitor, with the same nominal sized screen.

For the test I used an array of supplementary hardware and software. On the hardware side I used a Pioneer laserdisc player and the latest Philips DVD 840 player, both of which will replay either NTSC or PAL based software.

Good software for a laserdisc player is relatively easy to obtain, but at present good software for DVD players is a trifle more difficult to find. Fortunately, the Village Roadshow organisation provided me with three new DVD titles including *Priscilla Queen of the Desert*, *La Boheme* and the ABC's *Wild Rhapsody*, which I regard as being the best test software of the three.

In a straight playoff, the Sony Profeel just didn't stand a chance. Whichever way I looked at the test software, the EF29 outshone the Profeel in every test and in every possible way.

The picture was sharper and cleaner, with no trace of colour smear. The linearity was outstanding, whilst the picture was square as well as true from corner to corner, and at every point across the face of the screen. Viewing during daylight hours with outside light and possible reflections creeping into the room from three different directions, there was simply no trace of those normal aberrant reflections which I have come to begrudgingly accept in my living room.

As I discovered, I simply could not fault the EF29's performance. It appeared to achieve everything that Sony had claimed of it, and fulfilled all of its performance goals with consummate ease.

At $2999, this is an expensive TV set. However as I discovered, the EF29 simply has no peer. If it proves to be half as reliable as my existing Profeel (Trinitron) monitor, it should similarly provide outstanding and trouble-free performance to a degree which few other TV sets can currently hope to match. ❖

Sony KV-EF29 Wega CTV

A 29" (74cm) colour TV receiver employing Sony's new FD flat screen Trinitron technology, coupled with other new refinements. Measures 572 x 716 x 525mm (H x W x D).

Good points: *Outstanding image and sound quality. Has a true multi-player remote commander, inputs for digital component video from a DVD player as well as composite and S-Video. Built-in SRS Labs' TruSurround System for two-speaker surround sound.*

Bad points: *Fairly expensive, also quite heavy (54kg).*

RRP: *$2999*

Available: *Selected Sony dealers.*

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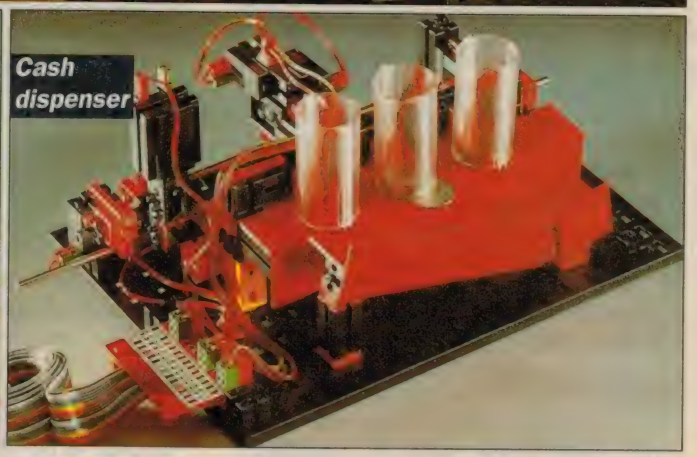

● Quality construction kits, manufactured in Germany, with two year warranty. ● Three computer controlled kits available; Profi Computing kit (builds 12 models), Turtle kit and Mobile Robots Kit. ● Software, ready to run, is provided for DOS and Windows. Source code in BASIC, C, Pascal, Delphi and VisualBASIC for windows allows you to modify existing programs or write your own programs. LLWIN a new flow-chart language - ideal for machine control - is now available on CD-ROM, PC-LOGO from Harvard Associates with robotic commands is also in stock. ● Two interface units are available, one plugs into the IBM-PC printer port the other 'intelligent' interface plugs into the serial port. Each provides eight on/off inputs, four forward and reverse motor outputs and two analogue inputs for position, pressure, light and temperature sensing. The number of inputs and outputs may be expanded on both units. The new 'intelligent' interface has an inbuilt microcomputer and operates from batteries giving your models complete mobile freedom! The interfaces and software may be purchased separately. ● Non-computer controlled kits are also available, including; I'm Walking a bionics kit, Cartech, Pneumatics and new Solar kit (from $149). ● Fischertechnik is recommended by Steve Cremer - winner of the US presidential award for science teaching.

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Reader Info. No. 2

RESEARCH TOOL OR Death

In a remote area of Alaska, the US Air Force and Navy have been building what they describe as an auroral research project, involving large amounts of RF energy beamed up into the ionosphere from a vast array of antennas. But many scientists, environmentalists and people living in nearby areas have become concerned about the project, and begun to question what it's *really* designed to explore...

by TOM MOFFAT

Deep within the forests of Alaska lies an antenna farm which looks more like the farm where they grow Hills Hoists. Imagine a flat block of land, covered in gravel, 305 by 366 metres. Within this plot stand 180 towers each 22 metres high, on a 12m by 15m grid, spaced 25 metres apart.

At the top of each tower, one above the other, are two sets of crossed dipoles — one pair covering 2.5 to 7MHz, and the other covering 7 to 10MHz. The whole works rises above a ground screen covering the entire area, mounted 4-1/2 metres above the ground.

Beneath the ground screen are 30 evenly-spaced transmitter huts. Each hut contains six pairs of 10-kilowatt transmitters which feed six of the towers. The total RF power output when everything is running is 3.6 megawatts. And this is only the small model...

This is ground zero for Project HAARP: 'High-frequency Active Auroral Research Project'. Although described as being a purely scientific research facility, the project is a joint effort between the US Air Force and the US Navy. The official description of the transmitter/antenna array is 'Ionospheric Research Instrument', or IRI. Official HAARP documents explain that the military is involved because they use communications that are affected by the ionosphere, so they want to find out as much as they can about it.

As technically savvy readers have probably deduced by now, the purpose of the crossed-dipole array over a ground plane is to beam lots of RF energy straight up, into the ionosphere. But more importantly, by varying the phase and amplitude of transmitter output into the various dipoles, it is possible to focus the beam and shift it in any direction — almost down to the horizon.

Thus, there are some very tight specifications on the transmitters: Each must produce a spectrally pure signal that is controllable over a 60dB range, from 10kW down to 10 milliwatts. According to HAARP documents, the design employs two 4CX10,000 tubes connected in push-pull, and it operates in class AB for a high degree of linearity. Harmonics must be at least 80dB below the fundamental, and above 45MHz all spurious signals must be at least 120dB down. Between 88 and 200MHz, the spec rises to 150dB. That's one clean transmitter!

For low power operation, the output stage can be bypassed and the antenna fed directly from the solid state 1kW amplifier that normally acts as the driver stage for the final amplifier. The transmitter low power input circuitry contains a digitally controlled phase shifter which permits each transmitter in the array to be set to a specific amplitude and phase, so as to produce an arbitrarily shaped antenna beam.

HAARP public relations material says the purpose of the IRI is to 'stimulate small localized regions of the ionosphere, to study in detail what nature produces at random'.

HAARP is not alone in this idea to tickle the ionosphere. Similar, smaller sites have been built near Fairbanks, Alaska; in Puerto Rico; and places like Norway, Peru, and Russia. HAARP differs from earlier sites in that its RF beam is steerable, it has wide frequency coverage, and it runs a much higher effective radiated power (ERP).

HAARP's power level of 3.6MW should give the ionosphere a pretty good jolt, but you ain't seen nothin' yet. According to people who have sighted HAARP internal documents, it's planned to expand the project until it can produce a beam of 1700MW — 1.7 *gigawatts*. Just to get this into perspective: even if the IRI is 66% efficient, it would take more than the total output of every dam in the Tasmanian Hydro Electric Commission (2509MW) just to power it.

According to one account, an abundance of electric power might have been the spark that got HAARP rolling. The prime contractor on the HAARP project is ARCO Power Technologies, a subsidiary of the ARCO oil company. It's said that ARCO's involvement was initially to find a use for 30 trillion cubic feet of natural gas reserves on the North Slope of Alaska. Since delivering the gas to US consumers was financially unfeasible, why not use the immense reserves to power enormous radio transmitters?

A scientist working with ARCO Power

Star?

A view of some of the HAARP antenna array, taken at sunset. (Courtesy HAARP)

Technologies, Bernard Eastlund, picked up the idea and eventually took out some patents. These patents resulted in a Defense Department sponsored research project called 'Alaska North Slope Electric Missile Shield'. And thus was born Project HAARP. Or so the story goes. Another account says Alaska was chosen because the earth's magnetic lines of force intersect the earth there...

The basic thrust of Eastlund's work was that powerful radio beams could turn a portion of the ionosphere into a reflector or lens, which could be used to redirect energy in any direction. One of his ideas was a 'full global shield' which could explode enemy missiles before they could cause any damage. HAARP does not acknowledge any involvement of Bernard Eastlund.

Opposition mounts

Many people are wary of attempts to modify the ionosphere, both from a safety standpoint and from fear of possible nefarious uses of the technique. There is a massive 'NO HAARP' campaign amongst university students in Alaska. And it's important to note the connections of some of the primary objectors.

Alaskan researcher Dr Nick Begich is the name most often associated with the anti-HAARP movement. He is co-author of a book called *Angels Don't Play this HAARP*. Dr Ross Adey has done work for the Brain Research Institute at the University of California, into the physiological effects of electromagnetic fields on tissue. Dr Patrick Flanagan has developed ways to produce useful input to the human body by direct electrical stimulation of the skin. And there are frequent references to the magazine *Microwave News*, published by Dr Louis Slesin.

Electronics Australia readers will recognize some of these names — they appeared in earlier articles on possible health dangers of EM fields, and links between cellular telephones and cancer. The issue here is much

the same, although on a vastly bigger scale. Watts versus gigawatts.

HAARP originated amidst considerable secrecy, but as opposition to the project grew, the project developed an open-door policy to try to allay public suspicion. Now they have a comprehensive Internet web site at **http://w3.nrl.navy.mil/projects/haarp/index.html**, filled with technical information, updates, fact sheets, and lots of photos.

However, it was necessary to employ the Freedom of Information act to shake loose other HAARP documents from a reluctant US Government. Among them is a Joint Services Planning Document issued by the Air Force and Office of Naval Research. It says HAARP's uses include 'providing communication to deeply submerged submarines, geophysical probing, controlling properties of radio waves, and generating mirrors which can be exploited for long-range, over-the-horizon surveillance purposes, including the detection of cruise missiles'.

These aims seem to extend somewhat beyond the realm of pure scientific research, so perhaps we should look in detail at some of the (alleged) uses of HAARP. Most of it centres upon HAARP's ability to generate ionospheric lenses or reflectors of around 50km in diameter. These appear to be more than mere pie-in-the-sky ideas. Much of the material that follows is a result of the Freedom of Information act; other documents come from sources we'd rather not know about.

Communications

We all know that the ionosphere plays a vital role in world-wide communications, especially via shortwave. The ionosphere can reflect radio waves; other times it's transparent and radio signals pass right through into space. HAARP will be able to manipulate the ionosphere so as to make it reflective *or* transparent, in places chosen by HAARP's operators.

On a trip to New Mexico, Tom spotted this Kirkland site with a sign saying 'EMP Simulator'. Is it a mini-HAARP?

This means, in time of war, the government can enhance its own communications while screwing up the communications of the enemy. It may even be possible to cause an artificially-generated ionospheric lens to act as an extremely low frequency antenna. If you then modulate the energy which sustains the ionospheric lens, information can be transferred to submarines cruising deep underwater. Goodbye Northwest Cape!

Should your enemy be employing a satellite for surveillance or communications, it should be a simple matter to slide an ionospheric reflector between the satellite and its ground station, blocking the signals.

Radar

Once an ionospheric reflector is established, you can pulse the energy that sustains it, checking between pulses to see what echoes come back. If the reflector is established at a low angle, far from the HAARP transmitting site, you have a very handy over-the-horizon radar.

Keeping in mind HAARP's lowest operating frequency, it should be possible for the RF pulses reflected from the ionosphere to penetrate below the ground, allowing the radar to probe for secret underground military installations. As this is being written, there is a standoff between the US Government and Iraq over Iraq's refusal to allow United Nations inspectors access to certain weapons storage facilities. If HAARP were operating today in its full configuration, the problem would perhaps be solved, at least from the US Government's point of view.

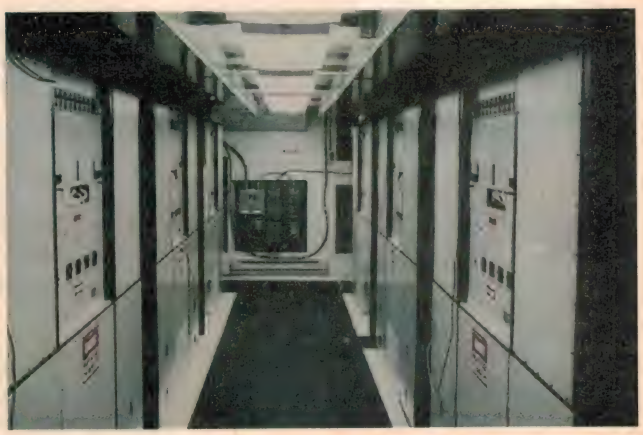
EMP weapon

Electromagnetic pulses (EMPs) have long been known as a side-effect of nuclear explosions. The energy released from the nuke manifests itself in the RF spectrum, as well as in the heat and light spectra. An EMP can do terrible damage to electronic equipment, especially that using solid-state devices. It's just like static discharge — only much, much worse. One good dose of EMP can zap an army's communications system, and all its computers, in an instant.

Valves can tolerate these short-term overloads, so it's common for modern military communications equipment to continue to use valves — to survive EMP. Russia is particularly keen on this idea, so there's still a thriving valve manufacturing industry in that country. Which explains why so many valves in guitar amplifiers are Russian-made...

One of the thirty transmitter huts. Each hut contains six pairs of high-linearity 10kW transmitters, for a total RF output of 3.6 megawatts. (Courtesy HAARP)

Inside one of the transmitter huts, showing the transmitter racks. (Courtesy HAARP)



The HAARP operations centre. It may not look all that intimidating, but that's a lot of RF engineering and power they can manipulate. (Courtesy HAARP)

If HAARP's ultimate 1.7GW rating is continuous power, then it should be possible to pulse the transmitter to much higher levels, for a brief instant. This would generate an EMP, on a scale similar to the nuclear bomb effect, which could be delivered to any target desired depending on phase and amplitude settings at the HAARP facility.

If the target were a major city, you could destroy its mains power distribution system and its communications system, and all its computers, while causing little damage to buildings or human life. (People may be briefly stunned by the EMP.) But the city's economic infrastructure would be in ruins. This may sound like an extreme thing to do, but it's certainly preferable to dropping a nuke on them instead. So we're getting into the realm of non-lethal weapons here (see *EA* July 1996).

It's interesting to note that the Air Force involvement in HAARP is directed from the Phillips Laboratory at Kirtland Air Force Base in Albuquerque, New Mexico. During a recent visit to Kirtland I happened upon an interesting structure of wires and towers, identified by a sign as an 'EMP Simulator' (see photo). Could this thing have been a 'mini' version of HAARP?

Weather changes?

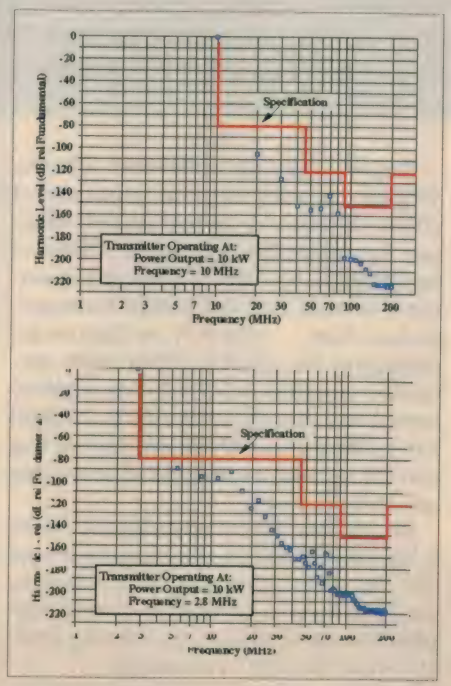
The earth's weather is primarily driven by pressure changes, which are in turn related to temperature changes in the air and in the sea. Lately we've been seeing some truly dramatic weather phenomena due to El Niño — torrential rain devastating California and Florida; vicious drought in Australia. These weather effects are primarily due to a small but significant increase in the sea temperature off South America.

If it were possible to modify atmospheric temperature by cooking it with HAARP, it could very well have an effect similar to changes in sea temperature. So a government could produce do-it-yourself El Niños anywhere it wanted. As with the EMP weapon, you could devastate an enemy's economy while causing little damage to human life.

Power transmission

The HAARP project seems to employ a lot of the technology developed originally by Nikola Tesla (see *EA* December 1995), namely the generation of enormous amounts of electromagnetic power to make things happen at a distance. One of Tesla's dreams was to transmit AC power from one place to another without wires. He did so successfully almost 100 years ago, powering lights in a house many miles away from a transmitting station in Colorado Springs.

One interesting experiment, allegedly performed by ARCO Power Technologies, used HAARP-style transmitters to power an electrically driven remote-controlled surveillance aircraft. It's claimed that sufficient power was transferred to keep the aircraft flying for 10,000 hours at an altitude of 80,000 feet.



Two plots of the HAARP transmitter harmonics at 10MHz (top) and 2.8MHz (above), for 10kW carrier output. As you can see, the harmonic and spurious levels are extremely low. (Courtesy HAARP)

Mind control

This is probably the most frightening of all alleged HAARP plans. Research has shown that it is possible to use RF fields to interfere with brain waves and physiological processes in the brain. Back in the 1960's, researcher Dr Jose Delgado was able to stop a charging bull in its tracks by sending signals to electrodes implanted in the bull's brain. Delgado proved that the bull's aggressive instincts could be thwarted by electronically manipulating the animal's reflexes.

Several years later Dr Delgado demonstrated that the behaviour of monkeys could be altered by subjecting them to pulsing magnetic fields. This time there were no antenna implants; mind control was direct.

More recently, Dr Ross Adey has been at the forefront of this research — his work has been primarily with microwave frequencies. He has shown that reaction in the brain is dependent on the frequency, amplitude and dose of the radiation used.

In a landmark experiment during the 1980s, Dr Adey modulated microwave carrier waves with extremely low frequency (ELF) signals to modify brain tissue responses. He worked with cat brain tissue, showing that the binding of calcium ions to neuron sites was affected by weak EM fields. The frequency and amplitude of the fields was similar to that of brain waves as detected on an electroencephalograph (EEG).

Dr Adey demonstrated how a 147MHz field, with an intensity of 0.8 milliwatts per square centimeter, caused a release of calcium ions from this irradiated brain tissue. The response only occurred when the ELF modulation of the microwave carrier wave was amplitude modulated at 6-20Hz. Maximum stimulation of the neurons took place at 16Hz.

Dr Adey's work showed that it is possible to modify brain function with electric fields, by modulating the fields at frequencies similar to natural brain waves. His work was done over a distance of centimetres, but HAARP's power level, modulated with the appropriate ELF frequency, could work worldwide.

By varying the modulation frequency, it could be possible to control a person's brain waves. After all, if it is possible to receive brain waves via an EEG, it should be possible to transmit them as well. According to some documents that have surfaced, the primary use of mind control would be to 'tranquilize' human populations.

A turn of a switch could cause a marauding army to lose interest in fighting. More importantly, if a government directed HAARP at its own citizens, it could cause them to become totally content and docile instead of questioning the wisdom of government actions.

Should the government choose to test this

facet of HAARP, the nearest American population other than in Alaska itself is on the Olympic Peninsula in Washington state, home of the author of this article. Perhaps they can make me stop writing about stuff like this, with one simple zap...

It appears that the Russians have already been using this kind of technology for real-world purposes. They have a gadget called the Lida machine, which transmits low-energy radio waves modulated between 0 and 100Hz. Lidas have been used for years to tranquilize psychiatric patients without physical contact.

Another Russian device, intimately familiar to Australian radio amateurs, is (or was) the Woodpecker. This powerful radio transmitter pounded out pulses, 10 every second — bang-bang-bang-bang. The Woodpecker could totally disrupt a radio conversation. Eventually radio manufacturers started producing receivers with special 'Woodpecker Filters'. The Woodpecker is now silent, its work apparently finished.

The US Department of Defense says the Woodpecker was an over-the-horizon radar designed to track American missile launches. But many scientists feel that the Woodpecker's real purpose was to experiment with modifying human brain function.

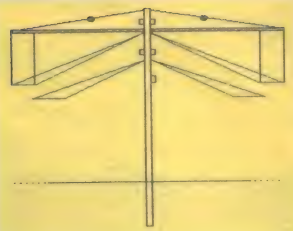
HAARP's dangers

Much of the objection to HAARP, in Alaska at least, is on environmental grounds. It's feared that HAARP will affect anything that walks, crawls, swims or flies.

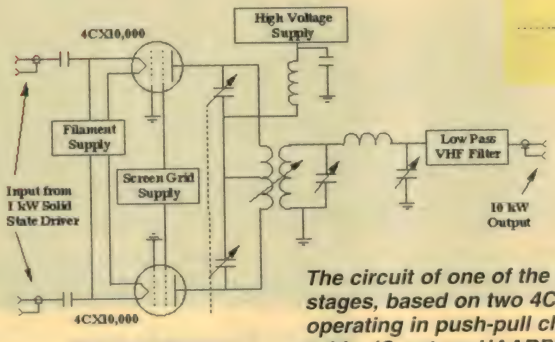
Although most of HAARP's radiation will be at high angles, there are still side-lobes to consider. At 3.6MW they could be considerable, and at the full 1700MW, there would be hot RF floating all over the place. People working on HAARP will be protected because they will be beneath the ground screen — there are even roads under it so they can drive from one transmitter hut to another with little RF exposure.

But outside the HAARP compound there is no shielding, and studies have linked electromagnetic exposure to a range of health problems including fatigue, irritability, sleepiness, memory loss, cataracts, leukemia, birth defects and cancer. Electromagnetic radiation can also alter blood sugar and cholesterol levels, heart rate and blood pressure, brain waves and brain chemistry.

Most closely affected are the Inupiat Indians, who live nearby. In 1993, Inupiat tribal advisor Charles Etok Edwardsen wrote to the White House: 'Many of us are not happy with the prospect of ARCO altering the Earth's neutral atmospheric properties. We do not wish to be anyone's testing grounds, as the Bikini Islanders have been...', referring to Pacific Islanders subjected to radiation exposure from US atomic bomb testing. Edwardsen has appealed to President Clinton to deny further funding to HAARP.



A fairly crude drawing of one of the antenna towers, showing the dipoles. The horizontal shield plane (line near the bottom) is 4.5m above the ground. (Courtesy HAARP)



The circuit of one of the 10kW final amplifier stages, based on two 4CX10,000 tubes operating in push-pull class AB, with grounded grids. (Courtesy HAARP)

...The bad news is that, if mind control works as planned, none of us may ever again be allowed to rant and rave and complain and knock the government or think for ourselves in any way. And the worst news is that the atmosphere may react in violent ways nobody ever though of, and blow us all to kingdom come...

Humans aren't the only ones affected. Wildlife can suffer the same physiological effects. Of particular concern are birds which may fly over the HAARP complex while it is operating. At best they will become disoriented; at worst they will become barbecued. Human fliers — pilots — are also on the endangered list. It's feared their minds may become scrambled, rendering them unable to control their aircraft. To avoid this, HAARP has installed a special aircraft detector that will kill the transmissions should an airplane approach too closely.

Beyond the range of physiological effects is the likelihood of interference to radio and TV. The HAARP people are sensitive to this, and they've installed a special telephone hotline so anyone who is having problems from HAARP can complain.

But the most worrying potential dangers from HAARP concern what could happen when enormous amounts of RF energy are pumped into the ionosphere. One concern is that HAARP could blast a hole through the ozone layer which would never heal. This would open the door to powerful ultraviolet radiations reaching earth and causing skin cancers. We already worry about the depletion of the ozone layer over Antarctica and the increased UV reaching southern Australia. Perhaps this will happen over North America — Canada — subjecting that country to hazards not of their own making.

Most dramatic of all is the possibility that HAARP could simply short-circuit the earth. There are fears that HAARP emissions, while very powerful themselves, could trigger something 1000 times again as powerful. This can be compared to the action in a transistor, where a small current into the base causes a much larger current to flow in the collector. Should this happen in the ionosphere, if it all becomes suddenly conductive, the resulting current could cause the entire ionosphere to go up in one gigantic flash of lightning. And with it, the earth. All because some guy in Alaska pushed a button...

So ends a story of good news and bad news. If it is true that HAARP is only an innocent research facility, not a tool of war, then it could well deliver some really interesting data on how the atmosphere works by providing artificial stimulation and observing the results. If it is true that HAARP is a weapon in disguise, then the good news is that it will largely replace weapons of death and destruction with weapons of the non-lethal variety.

The bad news is that, if mind control works as planned, none of us may ever again be allowed to rant and rave and complain and knock the government or think for ourselves in any way. And the worst news is that the atmosphere may react in violent ways nobody ever though of, and blow us all to kingdom come. We shall observe Project HAARP with interest... ❖

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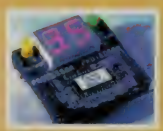

Avoid CPU burnout! Make sure you have the motherboard jumpers set correctly. This unit checks and displays the voltage on the CPU socket before the CPU is inserted. Ideal for those who upgrade systems, install motherboards, sell processors, build systems, service and repair or for educators and schools.

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NASA'S Last ON TROUBLED

Australian-born NASA astronaut Dr Andrew Thomas is currently part way through a four-month tour of duty on Russia's orbiting Mir space station. Many have expressed concern for the safety of Thomas and his Russian colleagues, in view of the serious mishaps which have occurred on the station in the last year or so — but after rigorous training in Siberia, Thomas himself was looking forward to the experience!

by KATE DOOLAN

Forty years ago, the then Soviet Union shocked the world when it launched the world's first artificial satellite, Sputnik 1. Consternation followed particularly in the United States when the Soviets launched the first animal, man and woman in space as well as the first human spacewalk and several planetary firsts.

In 1998, the Soviet Union no longer exists and their once-vaunted space program is a shadow of its former self. Nowhere is this more obvious than on the Russian space station Mir, which has seen a year of moving from one disaster to another, bringing on calls for it to be abandoned.

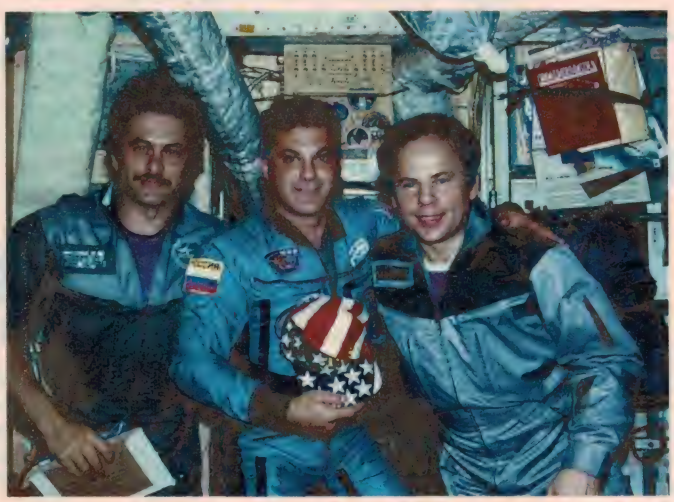
Since March 1996, the National Aeronautics and Space Administration (NASA) has had American astronauts living on Mir on a continuous basis, and the arrangement is planned to last until this May — the end of Australian astronaut Dr Andrew Thomas' current tour of orbital duty.

Astronauts Dr Shannon Lucid and John Blaha spent the better part of 1996 and early 1997 on Mir without any discernible problems. In January 1997, the space shuttle Atlantis on flight STS 81 brought John Blaha home and left Dr Jerry Linenger on Mir until May. It was to be an eventful and sometime dangerous stay for Linenger.

One of the more dangerous situations that the crew of Commander Vasily Tsibliev, Alexander Latuzkin and Linenger found themselves in was on 24 February 1997, when a fire broke out as the crew was changing an air filter. The brief fire in the Kvant 1 module began when a lithium perchlorate canister used to supplement the oxygen supply ruptured, and exposed the metal holding device to extremely high temperatures.

The fire filled the station with smoke, and the crew had to put on oxygen masks to breathe. Linenger described the smoke "as the most surprising thing to me. I did not expect smoke to spread so quickly. It was a magnitude about 10 times faster than I would expect a fire to spread on a space station. The smoke was immediate, it was dense and where I was sitting, I couldn't see the five fingers on my hand."

During Linenger's stay, other problems took place — including the failure of an oxygen generator and a leak in the cooling system. However it wasn't all bad, as Linenger and Tsibliev made the first joint US-Russian spacewalk on 29 April to attach and retrieve several experiments which were designed to collect data on the space environment. After the successful five-hour spacewalk, both Linenger and Tsibliev had high praise for the mobility of the Russian space suits, which enabled the pair to move around the station with relative ease.



An in-orbit portrait of the Mir crew in October 1997, with US astronaut David A. Wolf (centre) flanked by Russian colleagues Pavel Vinogradov (left, flight engineer) and Anatoly Solovyev (right, commander).

On 15 May 1997, the shuttle Atlantis was launched from the Kennedy Space Centre in Florida containing the crew of STS 84, which included Russian cosmonaut Yelena Kondakova and Linenger's replacement Dr Mike Foale.

Most of the time when Atlantis was docked to Mir was spent moving supplies back and forth, including a new oxygen generator and three thousand litres of water as well as personal and scientific supplies for Mike Foale. Russian space officials wanted the STS 84 crew to flush out water thought to be poisoned by antifreeze, but NASA officials demurred and scheduled the dumping for the next link up.

On his return to Earth, Linenger surprised everyone by walking off the space shuttle, after 132 days in space. In his first interview he complained that basic survival often got in the way of his scientific research program.

Tour OUTPOST

On June 24 last year, a Progress supply craft refused to respond to docking commands and rammed Mir, causing the solar array panel damage visible here and puncturing the Spektr module — which depressurised.

Supply ship prang

The most serious and dangerous incident on Mir took place on 24 June, as Commander Vasily Tsibliev was attempting to dock a Progress supply ship with the space station. The Progress refused to heed Tsibilev's commands and rammed the station, damaging the solar panels and puncturing the hull of the Spektr module where Mike Foale had his living and working quarters. The rupture sent air out of the Spektr module, forcing the crew to seal off that part of the station. The damage to the solar panels knocked out half of Mir's power supply and the station was sent into a spin.

This began a struggle to keep Mir operating, as the crew spent a major portion of their days in darkness. In the following fortnight, the space station's computer was accidentally disconnected, gyroscopes shut down and leaks from Spektr were observed. On top of all this, Vasily Tsibliev recorded irregular heart beats during exercise and was declared unfit to repair the Spektr module by a spacewalk. When he returned to Earth, it was found that Tsibliev had serious heart problems and was suffering from extreme stress.

On 07 August 1997, the Russian relief crew of Commander Anatoly Solovyov and Pavel Vinogradov were launched into orbit and soon docked with Mir. After a week of changeover activities, Tsibliev and Lazutkin returned to Earth where they found out that they were the scapegoats for Mir's problems, and were publicly criticised by Russian President Boris Yeltsin.

It was decided that Solovyov and Vinogradov would do the spacewalks in an attempt to get Mir back into some sort of working order. After a series of daring spacewalks both inside and outside Mir, things started to return to some semblance of normalcy. Mike Foale also participated in one of these spacewalks.

Congress hearings

Meanwhile back on Earth, Mir's troubles were attracting the attention of Congressman Jim Sensenbrenner, who heads the US House of Representatives' Space Subcommittee. Long a critic of American participation in any cooperation with the Russian space program, Sessenbrenner ordered a series of high profile public hearings during September on the safety of Americans on Mir.

Sessenbrenner claimed to be concerned about the problems Mir was having, and the time and money NASA were spending on the cooperation. One of the most influential witnesses was former astronaut Frank Culbertson, who is now head of the NASA/Mir program. When asked if he would go to Mir, Culbertson answered in the affirmative and his wife sitting behind him also gave her approval.

Another embarrassing problem came up for NASA when it was announced that Mike Foale's replacement Naval Commander Wendy Lawrence was too short to fit into a Russian spacesuit, and would have to be replaced by her backup Dr Dave Wolf. However as Lawrence had so much knowledge of Mir's systems, she still would fly aboard STS 86, which was scheduled for launch in late September.

Before STS 86 could launch, NASA Administrator Dan Goldin requested former astronaut Tom Stafford and aerospace executive Tom Young to study the problems with Mir and report back to him before he would make the launch decision. Both Stafford and Young said that it would be safe for Dave Wolf to live on Mir.

To put things in some perspective, it was pointed out that Mir was only designed for a five-year life and now has been in orbit for 11 years. If anything happened whilst Atlantis was in orbit, commander Jim Wetherbee would make the final decision on whether to leave Wolf on Mir.

Dr Jerry M. Linenger pictured on Mir soon after the start of his tour of duty in early 1997. He replaced John Blaha.

US astronaut C. Michael Foale, who spent four months on Mir in mid 1997, pictured with fruit brought by the STS-86 crew.

STS 86 was launched on 25 September 1997 and docked with Mir two days later, to be greeted by an ecstatic Mike Foale. Once Jim Wetherbee embraced Anatoly Solovyov, the first present he gave him was a new computer for the space station as the current one had been giving the crew major problems. As usual, the exchange of equipment took place with Mike Foale giving Dave Wolf briefings on the space station and daily routines.

Spacewalk highlight

One of the highlights of the STS 86 flight was a spacewalk conducted by astronaut Scott Parazynski and cosmonaut Vladimir Titov, who both wore American space suits. One of the tasks was to remove scientific instruments that had been left by NASA astronauts in March 1996 and the other task was to install a cone-shaped cap over the damaged area of the Spektr module, so further repairs could take place at a later date. Whilst the five-hour spacewalk was taking place, Solovyov and Vinogradov installed the new central computer for Mir.

STS 86 returned to Earth on 06 October. During a brief interview with the media, Mike Foale talked emotionally about his flight and the scapegoating of his two former crewmates. At about this time, a Russian report was released which exonerated the crew for Mir's problems. It cited overwork, insufficient training and deficiencies in the Russian space program, which has seen its budget plummet to an all-time low.

As this was written, Dave Wolf's flight had been uneventful with no major problems. He was undertaking a rigorous scientific program which includes biochemistry, a Canadian Protein Crystallisation Program to provide research on 32 different proteins specifically looking at debilitating diseases such as breast cancer, Alzheimer's disease, AIDS and meningitis. Wolf's body was also being used as a laboratory, with numerous experiments being carried out on him including bone loss analysis and kidney stone research.

Worse kept secret

On 10 October 1997, one of NASA's worse kept secrets was revealed when it was announced that Dave Wolf's backup Aussienaut Andy Thomas would replace Wolf on Mir in January 1998. Andy had been training in Russia since January 1997, and by all accounts it had been a hectic year for him. In a letter to me, he described spending most of his days studying manuals, plus completing all cosmonaut training on Soyuz and Mir including oral exams in Russian — then spending his evening improving his Russian, which he could not speak at the beginning of the year.

He also had to participate in survival training, and in his own words "...winter survival training took place in the far north of Siberia, in a place called Tiksi. Get an atlas and look it up. You will not believe where it is. They left us for two nights on the tundra. The temperature

Australian-born Dr Andrew Thomas, currently on board Mir as the last NASA astronaut to serve on the station.

got down to minus 40 degrees Celsius. It was quite an adventure."

"But I must say, living and working over here is a most interesting experience. I always hoped one day I would be an astronaut, but I never believed that I would ever undergo cosmonaut training!"

By the time you read this, Andy Thomas should be well into his four-month stay on Mir as the launch of STS 89 was scheduled for 15 January 1998 onboard the space shuttle Endeavour. Andy will return to Earth during May 1998 aboard STS 91, bringing to an end Phase 1 of the International Space Station (ISS) program which has maintained a continuous American presence in space and developing procedures and hardware for the ISS.

The International Space Station itself will start launching in mid-1998, with crews living aboard from early 1999. An exclusive article on Andy's stay on Mir will appear in *EA* soon as possible after his return to Earth.

As for Mir, it has been announced that it will be abandoned by early 1999 with controlled reentries over the Earth's oceans, as it is too large to bring back by the space shuttle. As it has an inclination of 51.6°, Mir could hit anywhere in the world unless bought down by controlled re-entry. Until then, it will be manned by Russian cosmonauts and possibly the occasional European visitor.

Ten years ago when I began to write about space, the Cold War was taking place and cooperation between the two superpowers seemed impossible; but it now appears that a lot of things can happen in 10 years. It will be interesting to see what will be occurring in 2007. Maybe even a joint mission to the Moon or Mars!

In closing, the author wishes to thank Colin Burgess, Debbie Dodds of the Johnson Space Center, Steve Fleming and Mark Hillyer, and of course Dr Andy Thomas for their assistance in the completion of this article. All photographs are courtesy of NASA.

Those readers who have access to the Internet may find it interesting to look at NASA's website at **http://www.nasa.gov**, and in particular its shuttle/Mir area at **/shuttle-mir/**. There's information on all aspects of the program, including interviews, video footage and historical documents. You might even see some messages from Andy Thomas, in orbit. ❖

Auto Electronics

Troubleshooting on a Mitsubishi TR Magna

We've covered basic operation of the electronic engine control system in earlier model Mitsubishi four-cylinder Magnas previously, but the system used in later TR models is different in a number of respects. Here's a description of the differences, and some information on troubleshooting typical problems.

Mitsubishi's early TM/TP Magnas have been covered in an earlier article (October 1996), and from that article you may recall that the control system, the spark injection and idle control were altered to provide maximum performance and pleasurable driving. Setting up the base idle on that system is quite difficult because of the nature of the system; on the TP, the idle speed is controlled by a nudger that opens the throttle plate.

In contrast, the TR Magna employs a different method of controlling the idle speed, in which a bypass port and pintle are used, under the control of a stepper motor.

Whereas the TP had two connectors on the ECM, the later TR has three connectors. Apart from this and the different idle control system there are quite a few other differences, as we shall see.

Ignition & injection

The ignition system is a standard distributor type and the ECM uses the various inputs to assess the required dwell and ignition advance. It then drives the ignition transistor (external power stage) via pin B4. The output is a pulse waveform that drives the base of the transistor.

The collector of the transistor is connected to the negative side of the coil and as can be expected when the base is driven the collector sinks to ground to 'charge' the coil. The transistor is turned off, and just like magic, we set fire to the mixture. The ignition coil resistance for the primary circuit is 0.72 - 0.88 ohms, while the secondary resistance is approximately 10.3 - 13.9k ohms.

The injectors are wired up to the ECM individually and have four separate output stages inside the ECM. The ECM has no injector ballast resistors and is directly connected to the 16-ohm injectors.

Standard test procedures apply when testing the fuel system. The fuel pressure and flow must be measured, because as with most systems the fuel pressure is set by the spring tension of the pressure regulator and the ECM does not measure the pressure or flow — so it will not compensate for any variations in or problems that may occur in the mechanical fuel system. If flow problems exist, then check for 12V at the pump and ensure that the pump can supply the required amount of fuel (normally for a four-cylinder engine it should be greater than 750cc in 30 seconds).

If problems do exist on a vehicle, do not overlook the obvious and ensure that the ignition coil and injectors have a healthy 12V supply. The supply for the ignition coil comes directly from the ignition key and power for the injectors comes via the control relay.

I have seen some faults on this type of system where the control relay ground provided on pins B13 and B16 of the ECM does not fully ground and therefore the vehicle will start briefly and then stall. Power supply to the injectors is interrupted and the problem with the above fault is that it tends to be very intermittent; I was only able to nail it down after some extensive bench work. If you do get such a fault I recommend that the ECM be replaced (very early in the diagnostic stage). See Fig.1 for the connections to the control relay.

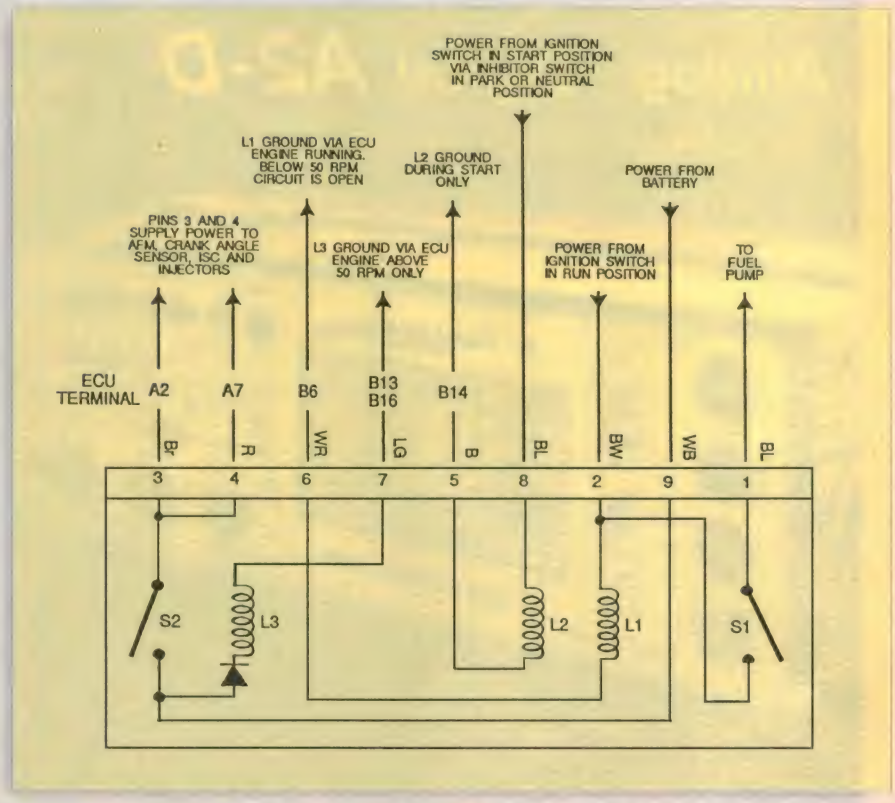


Fig.1: The connections to the TR Magna's control relay, with the corresponding connections on the ECM itself also shown.

CODE	DESCRIPTION	CODE	DESCRIPTION
11	Oxygen Sensor	23	TDC Sensor
12	Air Flow Sensor	24	Vehicle Speed Sensor
13	Intake Air Temp Sensor	25	Atmos. Pres. Sensor
14	Trottle Position Sensor	31	Knock Sensor
21	Coolant Temp Sensor	36	Ignition Timing Signal
22	Crank Angle Sensor	41	Fuel Injectors

Fig.2: The diagnostic codes produced by the TR Magna's ECM. It's fairly easy to check these with a LED and series 1k resistor, connected between pins 1 and 10 of the diagnostic connector.

System trigger

The system trigger is located inside the distributor and consists of two Hall sensors that give the ECM information about the relative engine RPM (C21) and crankshaft position (C22).

The distributor has four connections. Two of the connections are described above (speed and position), while the other two are the power supply for the Hall sensors. Positive 12 volts is supplied to the distributor from pin A5 of the ECM and ground is standard old chassis ground.

Testing the trigger system is best done with an oscilloscope, but you can turn the motor over slowly by hand and ensure that the outputs from the distributor are going between zero and five volts with a multimeter. Check the supply to the distributor from the ECM (5V, 5V and 12V, plug disconnected and the key on) and if they are not available check the power supply to the ECM. If the grounds and supplies are OK you may have a dud ECM, because many Magnas do have internal power supply problems.

If you do want to check the power supply to the ECM, +12V is applied to ECM pins A2, A7 and A10 while 0V (ground) is applied to pins A1, A6, C17 and C24. As well as 12V being supplied to the distributor from the ECM, there is also +5V reference (pin C23) available for the air flow meter (AFM) and the throttle position sensor (TPS).

Diagnostic codes

One way to check whether the ECM has got power supply problems or the microprocessor is 'brain dead' is to check if the ECM is generating diagnostic codes. When I receive an ECM for repair the first thing I do for a TR Magna is to connect the +12V and grounds and ensure that the codes are coming out of pin C1. It is relatively easy to do this with an LED tester connected between ground and pin C1. The ECM continuously generates codes from pin C1 and does not need any other grounding etc.

Mitsubishi dealerships have the jump on most of us because they have the MUT tester. This unit plugs into the diagnostic connector of the entire Mitsubishi range of vehicles and it displays all sorts of wonderful information — from the general codes to idle motor position and engine RPM. But the rest of us mere mortals have to count pulses.

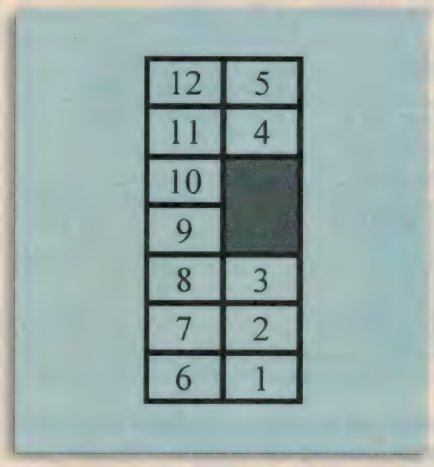


Fig.3: The connections for the diagnostic connector, located next to the fuse panel just near the accelerator pedal.

Each code is represented by two series of pulses, separated by a pause. The first series of wide pulses represent the tens, and the shorter pulses the units. So 'long-long-short-short-short' represents code 23 (TDC sensor). Fig.2 lists the codes available on the Magna system, and what they correspond to.

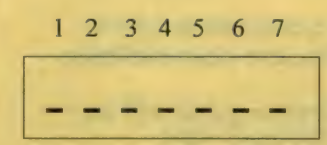
I mentioned before about power supply problems. If there are no codes available, check the power supply to the ECM. If supplies are intact and there are still no codes, smell the ECM — yes, you read correctly, *smell* the ECM. If it has a funny charcoal smell, chances are that the 'smoke' has escaped. And we all know what that means — collecting the smoke and stuffing it all back into the correct places is somewhat impossible.

If the circuit board has black marks on it, it may be quite unfortunate for the customer because more often than not the internal 5V regulator has given up the ghost and applied battery voltage to all of the logic circuitry. The microprocessor is not particularly fond of this treatment and quickly states its objection by refusing to play ever again. The result is no activity on either the address or data lines and a toggling reset line. So if you find this, end of story: your customer needs another ECM.

So the easy way to tell if the ECM is U/S is to check for codes on pin C1. The diagnosis connector is located next to the fuse panel, just left of the accelerator pedal. The connections are shown in Fig.3. Pin 12 is 0V, pin 1 is codes out (C1) and pin 10 is connected to pin C2 on the ECM.

Even without an MUT, then, you can get codes out by using an LED (and series 1k resistor) between pins 1 and 12 of the diagnosis connector. Remember no codes could mean serious trouble.

To clear the codes and with the ignition key in the off position, remove a battery terminal for approximately 20 seconds. When the supply is reconnected the LED should continuously flash, indicating a pass code.



Temp Deg. C	Volts
0	3.2 – 3.8
20	2.5 – 2.7
40	1.7 – 1.9
80	0.6 – 0.8

Fig.4: At left (a) are the basic connections for the TR Magna's air flow meter (AFM). The table at right (b) shows the output voltage as a function of air temperature.

Air flow meter

The Air Flow Meter (AFM) is a Karmen vortex type and generates a frequency proportional to the induced air. The AFM has a vertical rod inside the air passage that deflects the air, and this deflection causes the air to snip in clockwise and anticlockwise vortices. The electronics then converts this signal into a 5V square wave of varying frequency, which is applied to the ECM. This in turn injects the correct amount of fuel.

The output frequency at idle is approximately 12 - 25Hz, while at 2000rpm it's approximately 70 - 90Hz. The output is measured across pins 3 and 5 (pin 5 is 0V).

The model TR is very different to the TP in the AFM department, because the TP had the AFM mounted inside the 'barrel type' air filter box, whereas the TR's AFM is mounted externally, after the air filter. The barometric (atmospheric) pressure sensor and air temperature sensor are also housed inside the AFM. See Fig.4(a) and (b) for details.

The Magna TR has all the other sensors relevant to a modern engine management system, such as an Oxygen (O2) sensor, Coolant Temp Sensor (CTS), Vehicle Speed Sensor (VSS), Idle Speed Control (ISC), Fuel Pump and air conditioning clutch control.

Temp.	Voltage
0	3.4 – 3.6
20	2.5 – 2.7
40	1.5 – 1.7
80	0.5 – 0.7

Fig.5: The output voltage characteristic for the Magna's coolant temperature sensor (CTS).

Specifications for the CTS are provided in Fig.5, while Fig.6 summarizes the connections to the ECM. The ECM and control relay are mounted in behind the passenger side kick panel and can be easily accessed for testing.

Pin	Description	Pin	Description	Pin	Description
A1	O volts	B9	ISC	C9	Knock sensor
A2	+12 volts	B10	Injector 3	C10	AFM
A3	+12 volts (backup)	B11	Injector 4	C11	N/A
A4	Neutral drive switch	B12	Canister purge	C12	Timing adjust.
A5	+12volts - Dist.	B13	Control relay	C13	Fuel pump relay
A6	0 volts	B14	Check engine lamp	C14	Idle switch
A7	+12 volts	B15	Air cond. control	C15	N/A
A8	Start signal	B16	Control relay	C16	Pressure sensor
A9	N/A	B17	ISC	C17	Sensor 0 volts
A10	+12 volts ign switch	B18	ISC	C18	Speed sensor
B1	Injector 1	C1	Diagnosis connector	C19	TPS
B2	Injector 2	C2	Diagnosis connector	C20	CTS
B3	N/A	C3	N/A	C21	CAS
B4	Ignition drive	C4	O2 sensor	C22	CAS (TDC)
B5	N/A	C5	N/A	C23	Sensor 5 volts
B6	Fuel pump relay	C6	AFM reset line	C24	Sensor 0 volts
B7	N/A	C7	A/C request	-	
B8	ISC	C8	Air temp sensor	-	

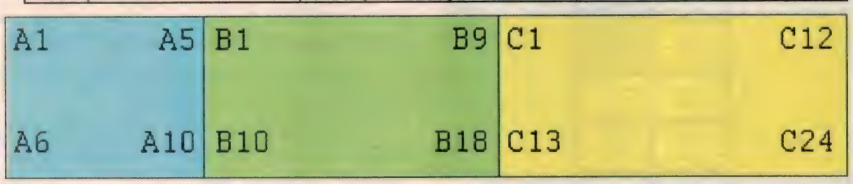


Fig.6: The significance of each of the connections for the three connectors A, B and C on the TR Magna's ECM, together with a diagram showing the location of the pins on each. The ECM and control relay are both located behind the passenger side kick panel.

Specifications for the CTS are provided in Fig.5, while Fig.6 summarizes the connections to the ECM. The ECM and control relay are mounted in behind the passenger side kick panel and can be easily accessed for testing.

Another fault that is peculiar to the late model Mitsubishi range is associated with the idle speed motor. The stepper motor has four windings of approximately 30 ohms each. The windings can intermittently become open and short circuit. The vehicle will exhibit idling instability and sometimes stall...

If the windings become short circuited, it can sometimes prove to be a real problem for the ECM. There is no over-current protection inside the ECM on the idle circuit, so we come back to the old problem of serious smoke escaping from the ECM. In this case the ECM micro itself still functions quite happily, but the main problem is the fact that the transistor array that drives the idle speed circuit is very black and crispy and that funny burning smell may appear.

Apart from the above ECM problems the electronics system is relatively reliable and providing the vehicle is regularly serviced and checked, it should be trouble free.

The base timing can be set by grounding the round 'timing check' connector. This is located under the bonnet near the fire wall, on the passenger side. Timing should be set to 5° before top dead centre (BTDC), +/-0.5°.

The fuel pump test connector is near the timing check connector, but it's a rectangular connector. With the engine running the fuel pressure should be approximately 265kPa, and with vacuum disconnected from the regulator it should increase to approximately 330kPa.

The base idle setting takes a bit of concentration and application and I will cover that as a separate item in a later column. The VACC has an excellent technical bulletin regarding the idle speed adjustment on the TR Magna, so if you are a member of the VACC I suggest you access the relevant details.

Good luck if you do come across a brain dead Magna, but here's hoping you don't!

Until next time, 'bye. ❖

Forum

Conducted by Jim Rowe

More on Dr Robert Beck's alternative electrotherapy devices

Here's some more information on the 'alternative electrotherapy' devices based on the work of US researcher Dr Robert C. Beck, who was introduced in last month's column. We look further at his Blood Cleaner, and also talk about one of his other devices: the Magnetic Pulse Generator.

As promised last time, and in an attempt to give a balanced coverage, we're continuing our look here at the 'electrotherapy' device designs promoted by the high profile US alternative health researcher Dr Robert C. Beck. You might recall that Dr Beck does seem to be one of the more credible people working in this field, partly because he doesn't sell any devices himself. He gives talks, publishes information and endorses/approves devices made to his designs — when he's not involved in developing and testing them, that is.

Incidentally from what I've seen lately, Dr Beck's doctorate seems to be a DSc rather than a more common PhD. (Just to set the record straight...)

Well then, last month we looked at the way Dr Beck's Blood Cleaner/Zapper/Plant Stimulator device seems to be based on the work of Dr Steven Kaali *et al*, as reflected in US Patent No. 5,188,738. The basic concept seems to be that passing a small electrical current through virus cells disables them in some way. Dr Beck's device claims to take the concept further, by using electrodes strapped to the wrist to pass a small current through the radial and ulnar arteries, so that the blood is 'cleaned' of viruses and other 'parasites' as it circulates through the patient's body in the normal way...

The basic circuit for the Blood Cleaner is shown in Fig.1; this has been redrawn from Dr Beck's own circuit, given in various places, both to make it a little easier to follow and also to avoid any possible arguments about copyright. As you can see, it consists of two different sections.

One section, on the left, is essentially a simple square wave oscillator using a 7555 timer chip (IC1), turning a small relay on and off via a driver transistor (Q1). The oscillator seems to be designed to work at about 4Hz, although in various sources Dr Beck is quoted as saying that the frequency isn't critical; apparently figures between 0.75Hz and 7Hz or so will work. (It seems to be largely intended to avoid any possible complications of using DC.)

The exact configuration of the oscillator seems a trifle weird, as you can see. It's not clear why there's a diode in the *negative* side of the 7555, nor why the small lamp is in series with the driver transistor — or for that matter, why the CMOS 7555 chip is used with a driver transistor, when a 'good old' bipolar 555 would be able to drive the relay directly. Still, despite these qualifications it no doubt works as stated.

The other half of the circuit is more straightforward, with the relay contacts acting as a simple reversing switch. These connect a 27V source (three 9V batteries in series) to the electrode socket J1, via fixed resistor R4 (1k) and variable resistor R5 (100k). So the end result will be a 27V peak square wave of about 4Hz, connected to the electrodes via an adjustable resistance of 1 - 100k, and thus giving a current adjustable between 27mA and 270uA, into a short circuit. The current between the electrodes strapped to someone's wrist would presumably be somewhat less than these figures, of course, because of the added resistance.

Note that there's a Test pushbutton S2, used to connect a pair of LEDs (or a single bi-colour LED) across the relay output, via series 18V zeners and a 2.2k resistor. The idea here is that pressing the button allows you to check that the device is working — the LEDs should blink alternately at the 4Hz rate.

It should be noted that the circuit of Fig.1 is Dr Beck's basic 'DIY' design, which various firms have elaborated/improved upon in producing the actual devices they market. For example Fig.2 shows a complete 'Silver Pulser' kit sold by North American firm Sota Instruments, where the electronics apparently contains an internal DC-DC converter which is used to allow everything to be powered from a single 9V battery. It's also claimed to incorporate 'constant voltage circuitry' to maintain the 27V output over the effective life of the battery.

The Sota kit sells for US$175 or $220 Canadian, plus $7 Canadian for international airmail shipping. By the way, the Sota device is called a Silver Pulser because like some of

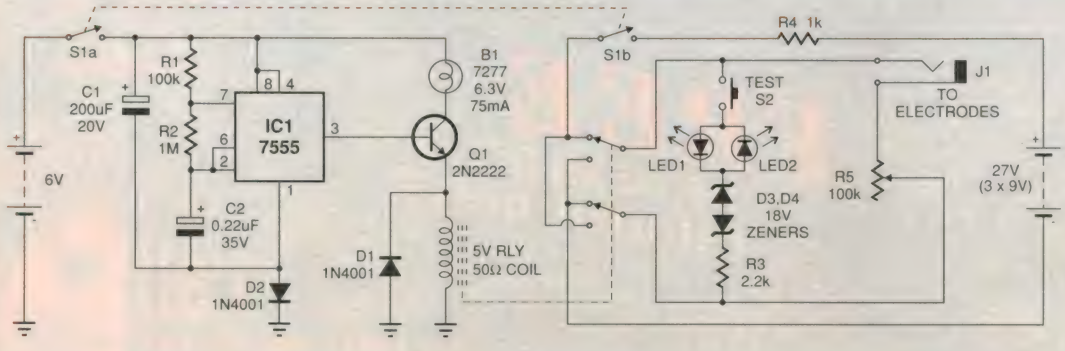


Fig.1: The circuit for Dr Beck's original DIY version of his Blood Cleaner, redrawn for clarity and to avoid possible copyright wrangles.

the devices I mentioned in earlier columns, it's designed to work as a colloidal silver generator as well as a Blood Cleaner. You can see the second set of silver wire electrodes at the very front of Fig.2.

It's perhaps worth mentioning here that with the Sota unit, there's no Test button; the red and green LEDs operate all the time. However there's a jack for an external 6-9V DC power supply, and the specification (on Sota's web site: **http://www.sota-inc.com/-silverzap/**) suggests a 300mA plug pack adapter. Which is rather curious, since Dr Beck's own material stresses that the Blood Cleaner in particular should only be operated from batteries, for safety. He specifically warns against using *any* line-connected power supply, transformer, charger or battery eliminator (see, for example, his paper on **http://www.explorepub.com/articles/-beck/article.html**) with the blood clearing device. Yet Sota claims its design is 'certified, approved and endorsed by Dr Robert C. Beck, DSc'.

I note also that Sota proclaims that its unit has an output frequency of '3.92Hz +/-1Hz' — a somewhat curious figure, especially when Dr Beck himself stresses that the frequency isn't critical.

As I mentioned last month, there seems to be a fair amount of anecdotal evidence that this kind of device may achieve some worthwhile results with certain blood-borne ailments. Also Dr Beck himself is reported to be working with a medical team in the San Diego area, on a research project aimed at coming up with some more solid evidence for its efficacy, with a view to getting official approval from the US Food & Drug Administration. If this happens it would certainly give the devices much more credibility than most.

Of course in order to judge the true credibility of this kind of device, you really need expertise in the health science area. And as many of my critics were eager to point out, I'm really well out of my league here.

Medical opinion

I was interested, then, to seek the opinion of a medico friend of mine — a GP, but a very knowledgeable man with BSc and MSc degrees in science, as well as a doctorate in medicine (MD) rather than the usual MB,BS. I gave him copies of Dr Beck's papers and other material on the Blood Cleaner, and asked for his frank and honest opinion. By the way he doesn't have any axe to grind here, as he has no shares in either the pharmaceutical companies or any private hospitals, and hasn't received (or been offered) any free BMWs or cruises in the Bahamas...

So how did he react, after wading through it all? Well, here are a few relevant snippets:

The articles that you sent me were full of medical gobbledegoop, explaining in great detail HOW the gadgets are constructed and WHY they work, but not IF they work. What is needed, of course, is a series of experiments in which half of the patients are treated with the gizmo turned on, and half treated with the gizmo turned off. Then perhaps we could argue about the design of the experiments and the irrelevant statistical methods used to analyze the results. This is what happens in the real world, and it leads to better experiments and more concise analysis of the results...

Bob Beck's article states that mild electrification of your blood does not kill viruses, but appears to inhibit the ability of the outer protein layer of the virus to attach to lymphocytes. This statement is a quote from an allegation made by the ubiquitous Dr Kaali in 1991 and refers to in vitro experiments. We are not told of the circumstances in which they were carried out, and what happened when the current was turned off. Beck makes the illogical leap to the conclusion that the virus is 'neutralised, immobilised and eventually eliminated from the body'. He later contradicts himself by talking about 'treatment-destroyed HIV', whereas in the previous paragraph he said that his electrification did not kill viruses.

I could go on and on nit picking, achieving little. For instance current flow through the body is probably through the tissues. Arteries are rather fibrous and would shunt

very little current into the blood itself. Again, the cells within the blood stream offer considerably higher resistance than the surrounding salty plasma. So what effective currents are we dealing with?

Treatments last for about one hour a day, for 'about three or four weeks'. He goes on to say that heavier infections can be treated for shorter times each day ('to prevent overloading patient with toxins'), but for a longer treatment duration. What are these mysterious toxins? According to the author, normal cells are not affected, nor are viruses killed. Later he says that there may be a fall in T-cell count from lysing (destruction) and subsequent scavenging by macrophages. He can't have it both ways. And even if this treatment were to neutralise all manner of unwanted bugs locally, what of the rest of them? The statistics of the situation are complicated. Somehow treating some of the bugs some of the time is not a medically sound principle...

His advice about abstaining from alcohol and drinking distilled water prior to, and following the treatment are without any physiological basis. Alcohol will certainly not interfere with his healing currents and no amount of water poured down the throat influences the clearance of toxins by the kidneys. Actually the kidneys process about 180 litres of blood every day, and re-absorb all but a couple of litres or so of the water and useful salts, dumping waste products which turn the urine the familiar yellow colour. When large amounts of water are drunk, volume receptors merely signal the kidney to re-absorb less water. So the whole idea of flushing out the system is rubbish.

Hmmm, there you are — hardly a ringing endorsement, as you can see. I guess we can summarise my medico friend's reaction as 'the explanation of how it's supposed to work doesn't make much sense, and I'd need more evidence of its actually working before I'd take it too seriously'.

Magnetic Pulser

But let's move on. One of the questions that had occurred to me, as a layman reading Dr Beck's stuff on the Blood Cleaner, was just how effective it could be in tackling viruses and other nasties that *weren't* resident in the blood. Even assuming that gizmos like his Blood Cleaner could remove them from the patient's blood, how effective would that be in terms of removing them from their system as a whole?

Well, it seems that the same thing must presumably have occurred to Dr Beck himself somewhere along the line, because he came up with another device design which in many ways seems intended to complement the Blood Cleaner. This one is called the Magnetic Pulser, and in keeping with his emphasis on self-help he has again provided fairly complete information for those who wish to make one themselves.

The basic purpose of the Pulser seems to be to 'neutralise' bugs that are resident in other parts of your body (like the lymph nodes, bones, in specific organs and perhaps in nerve sheaths). And the claimed principle of operation is that of a pulse transformer: by applying a pulse of energy to a coil held on the surface of the body above the region to be treated, a strong pulsed magnetic field is created, and currents thereby induced in the underlying tissues and/or organs — to again 'neutralise' any bugs therein.

Dr Beck's original 'DIY' Magnetic Pulser is essentially a modified electronic flash unit, of the compact type operating from four AA cells. He suggests one with about 35 joules of output.

The idea is to wind a coil of about 130 turns of 14-gauge (AWG) enamelled copper winding wire, on a former made from a VHS videotape spool, with two 100mm fibreboard disks and a 6mm machine bolt used to strengthen the former during winding (but removed afterwards). The resulting coil has an inductance of about 0.94mH, and a DC resistance of about 0.34 ohms. An alternative coil, he suggests, is an air-cored loudspeaker crossover inductor of 2.5mH.

Whichever coil is used, it's then well insulated, fitted with a short cable and connected in series with the flash tube and its dump capacitor in the electronic flash unit. As a result, when the flash is fired most of the capacitor's charge is dumped into the coil to produce a brief but intense magnetic pulse.

In short, the electronic flash unit is simply and effectively converted into a low-cost but fairly high powered pulse generator, feeding the coil. According to Dr Beck the pulsed magnetic field from the coil penetrates about 100mm into the body when a 35J electronic flash is used, and can 'theoretically neutralise electro-sensitive viruses such as herpes B, HIV, hepatitis, Epstein Barr and possibly many others...' However while it delivers an output intensity 'several hundred times' that of competing devices, and is therefore considered more effective, it's 'considered safe to use anywhere on the head, chest and body except with cardiac pacemaker users'. Also 'exposure levels are considered safe because the intensity of this magnetic pulser is much lower than Magnetic Resonance Imaging, in routine use on tens of thousands of patients'.

Needless to say there are commercial versions of the Beck Magnetic Pulser, for those who don't wish to make their own and don't mind paying more. Fig.3 shows a version produced by Sota Instruments, which they sell for US$195 or $250 Canadian. According to the specification on their web site, it delivers 32J of energy into the coil in a pulse lasting 2.5ms, producing a peak field intensity of around 21.5 kilogauss.

And the reaction?

Needless to say there's no real way of knowing whether or not the Magnetic Pulser would be likely to do what is claimed of it, without conducting full scientific field trials. So I was interested to know see what my medico friend thought of it all, and whether he thought such trials would be worth doing (if one only had the money). Here again are snippets from his comments:

The inductively coupled magnetic pulse

Fig.2 at left shows the Sota Instruments Silver Pulser kit, which can be used for both 'blood cleaning' and making colloidal silver water. Fig.3 (above) shows Sota's version of Dr Beck's Magnetic Pulser.

generator can apparently 'neutralise Hep-B, Herpes, HIV, Epstein Barr and possibly many others as yet undiscovered (viruses) that can hide within nerve sheaths and are therefore untouchable via immune system, white cells or injectables'. There is a hint of truth here. Herpes viruses can indeed hide in the nervous system in an 'inanimate' form — not in nerve sheaths, but in the actual ganglia. It is impossible to kill them here, not because they are hiding, but because they are in an inanimate form, and as such cannot be 'killed'. No other viruses to my knowledge use this trick.

It is also interesting to note that his do-it-yourself machine delivers stronger magnetic pulses than many inferior brands, and therefore will work where theirs will not (i.e., stronger is better). Yet it's safe, because the magnetic field is many times 'weaker than pulses used in Nuclear Magnetic Resonance imaging, in routine use in tens of thousands of patients'. His logic would lead me to suppose that all of these tens of thousands of patients would be automatically wiped clean of all viruses, bacteria, fungi etc., each time they were scanned. Curious that no one has noticed this...

He suggests that one should enclose the coil in a plastic zip-lock sandwich bag, 'for sanitary purposes'. This does not inspire confidence!

As you can see, my medico friend doesn't seem too impressed with the Magnetic Pulser either — and points out that if it *does* work, presumably everyone who has an NMR scan should be cleaned of all bugs too. If this were true you'd think there would have been quite a lot of publicity, and people forming enormous queues outside NMR scanning clinics.

But that's all we have space for this month. I'll try to give details of Dr Beck's Brain Tuner device next month. ❖

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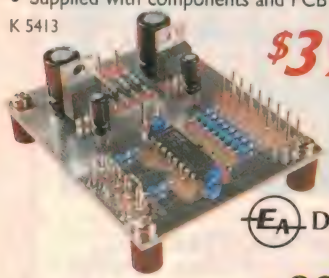

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NEW DESIGN

Attention Customers

We have discovered some minor errors in the original instructions and parts list to the Universal Charger kit, K3216, as featured in Feb /March 1998 Silicon Chip, that has delayed the release of this product. We are working closely with Silicon Chip to ensure that the kit, when assembled, performs as per the specifications in the above issues. We apologise for these delays, but are looking forward to releasing this kit shortly.

Availability: Our kits consist of many different parts from numerous suppliers. Whilst we have consulted closely with them and are satisfied as to their ability to supply, sometimes problems can arise in obtaining all of the parts. This means there is a slight chance that availability may be delayed. Rainchecks are available, however if you'd like to check beforehand, please don't hesitate to contact your local store.

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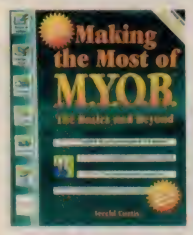

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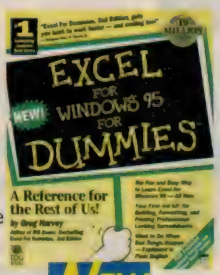

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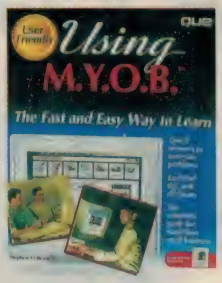

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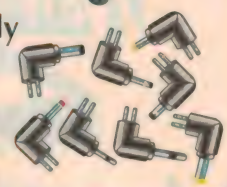

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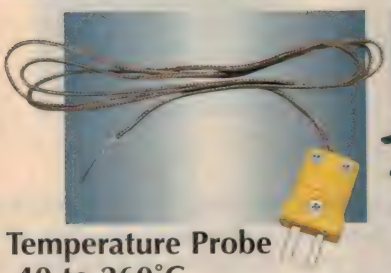

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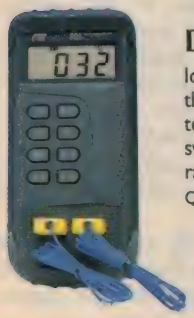

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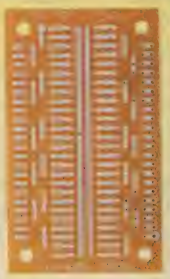

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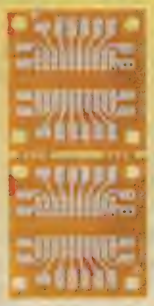

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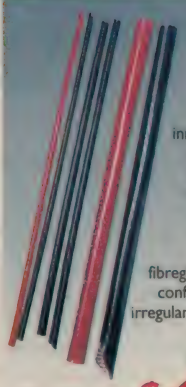

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Serviceman

"Transistorised equipment is heat sensitive, and has to be kept in a cool place!"

I have two interesting stories for you this month, one from my own bench involving a small stereo system with an intermittent fault — which the owners tolerated for about eight years, because one of the manufacturer's service centre staff led them to believe that it was 'normal' for transistorised gear to behave in that way. Tracking down the actual fault wasn't too easy, though. The other tale is about refurbishing an old valve-era oscilloscope...

This story began some time before 1988, when a young couple bought a Philips stereo system comprising an AH160 tuner, an AH260 preamp and an AH360 power amplifier. They were quite happy with it for six months or so, but then one night it just stopped. Next day much the same thing happened and after a week or two it was happening twice a day.

They soon learned that the system would only play for one or two hours, but could be rejuvenated by turning it off for half an hour or so before switching it back on. This wasn't very satisfactory for a near new stereo, so it went back to Philips. Several times...

I find this next part hard to believe, but I am assured that they were told by the counter staff at Philips Service that "...it can't be repaired, it's not faulty! This is normal for transistorised equipment. It's heat sensitive and you have to keep it in a cool place."

Well, they kept it in the coolest part of the house, but the system still played up — until one day it just would not fire up at all. This was in January 1989 when I was brought into the picture for the first time.

I was told about the intermittent cutting out, but my first task was to find out why it wouldn't start at all. My records show that at that time I found:

1. A loose nut on the power amp's transformer that created a loud buzz;
2. Dry joints on the preamp's power transformer; and
3. An open circuit primary on the tuner's power transformer.

How's that for a collection of faults in a product then just over 12 months old?

Anyway, I solved all of *those* problems and then went looking for the intermittent no-go. I don't recall exactly what I did at that time, but I do know it was two weeks before I called the customer and told him that I couldn't fault the system and that their problem must have been associated with the dry jointed power tranny in the preamp.

"Please FIX it!"

Now we fast-forward to November 1997, eight years on. The lady turned up at my workshop with the system in the boot of her car. She told me that they were absolutely fed up with its erratic behaviour and asked if I would try to solve the problem, once and for all.

It seems that for eight years they have been putting up with a stereo that would only play for an hour or two before demanding time off for relaxation! I still can't believe what they claim to have been told by Philips, but they must surely have heard *something* then, to cause them to suffer the erratic behaviour for so many years.

I set up the system on the bench and connected it to my test speakers. It fired up without trouble and produced a really fine tone. It may have been something less than top-end gear, but it could only have been faulted by one of the Golden Ears Company.

So, for two or three days it performed perfectly. But then it suddenly cut out — exactly as the owner had described.

Unfortunately, this was a three-piece setup and the fault could have been in any one of the pieces. But I'm an old campaigner and I have a few tricks up my sleeve. One of them was to disconnect the tuner and poke a small screwdriver into the preamp input socket.

In this case, it produced a healthy 'blaap' from the speakers. Which proved to me that, at least, the pre and power amps were still working. This left the tuner as the culprit.

At this point part of the problem revealed itself to me. I accidentally moved the tuning knob and suddenly the station that had just cut out was back. I didn't twig immediatley, but before long I realised that the problem wasn't that anything stopped working — just that the tuner drifted until the mute cut in and silenced the signal.

I proved the point by switching off the 'Mute' function. After that, I could hear the station slowly drifting with noise and distortion increasing until the signal was unbearable.

So now that I knew what the trouble was, the problem was to find and fix it.

There was a suggestion that the trouble was heat sensitive, but as it happened on cold mornings or hot afternoons, with the cover on or off, it seemed that heat was only a part of the problem. So where was I to start looking?

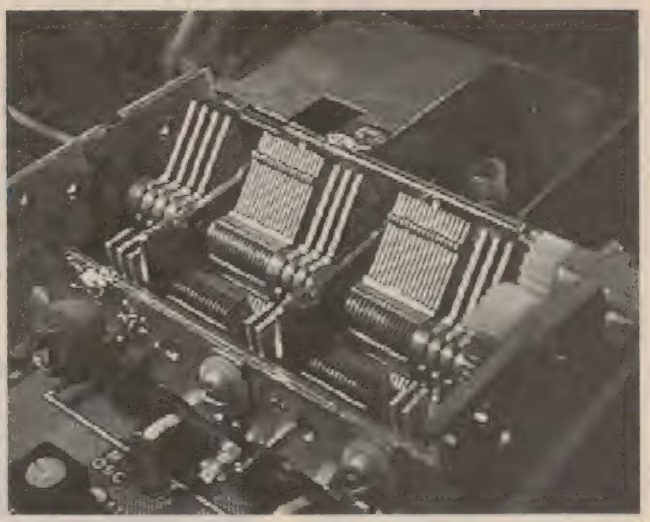
Fortunately, the AH160 offers a few aids to diagnosis. The front panel carries three LED displays that show (a) signal strength, (b) tuning balance, and (c) stereo on/off. The tuning balance showed clearly that the tuning was drifting high as the cutoff point approached. Coincidentally, the signal strength dropped until the stereo LED went out and the signal stopped.

From all of that, I deduced that the problem lay in the front end, and most likely in the local oscillator. At first I hoped that the tuner used a varicap for fine tuning as drift here would be relatively easy to find and fix. But it was not to be.

The ganged tuning capacitor was mounted on a small sub-board, along with the relevant coils, transistors and minor components. The shield surrounding the oscillator section was made of heavy galvanised iron and was firmly soldered down onto the earthy pattern on the main board. There was no hope of easily removing the sub-board

for a close examination.

The circuit diagram gave no help either, since the whole RF stage was shown as a block, with only antenna in, 12V in and IF out. There was no sign of any AFC input, so that absolved the IF stage from any responsibility. Whatever the problem was, it had to be associated with this sub-board.



The tuning capacitor of the Philips AH160 tuner, with the FM gang sections clearly visible. At bottom left is the substitute trimmer.

Grab the freezer

I poked and prodded around the circuitry without any positive result. It did not seem to be a mechanical fault. So I got out a new can of freezer spray.

At first, spraying the oscillator components inside the screen produced immediate results. But I soon realised that I was on the wrong tram because the fault disappeared almost immediately, as soon as the frost evaporated from the board. The real fault, whatever it was, took a lot longer to come and go.

So I began spraying around other components on and near the sub-board. Some areas appeared to be more touchy than others, but there was nothing I could definitely finger as the villain.

After a long process of testing and deduction, I decided that it was the gang capacitor that was somehow associated with the fault. The trouble appeared whenever the spray went anywhere near the fixed plates of the oscillator section.

At first I wondered about the mechanical rigidity of the assembly, but there seemed to be no change in performance after I had wedged the plates against the frame with a piece of foam plastic. It still responded to the freezer spray, either wedged or loose.

After a time, and after using almost a whole can of spray, I concluded that one end of the fixed plates was more sensitive than the other. And this led me to the real culprit — the oscillator trimmer capacitor.

A closeup of the original trimmer, sitting on a five-cent coin to show its tiny size. It turned out to be the cause of all the trouble...

The trimmer was mounted on the outside of the gang frame, between the frame and the end of the fixed plates. Although it was only a tiny component, I needed a heavy iron to unsolder it from the gang frame. The other end came away easily with the small iron.

With the trimmer removed, I found I could tune a few stations at the lower end of the dial — so I left the set to run and went on with some other business. Many hours later it was still playing away quite happily, and what's more, no amount of freezer spray had any effect on it.

Case proved! But I still had to finish the job.

I've got a drawer full of trimmer capacitors, but they are all old compression or concentric types. I had nothing in the way of miniature components. I had to make a special trip to town to see what I could get.

As the service manual gave no details of the RF block, I had to guess at the value of the faulty trimmer. As it was such a tiny thing, I settled on the smallest standard value, 1.8pF to 22pF.

It took a bit of fiddling to get the new component into place (and that plumber's iron to solder it to the frame!). But it was eventually done, and the first test run had me stamping my feet in frustration. Now I had no stations at all.

Then I tried adjusting the trimmer, first for lowest capacity, then the highest. This revealed stations on various parts of the dial and my problem became one of trying to get them to line up with the dial markings.

The new trimmer seemed to be unbelievably touchy and difficult to adjust precisely. So I recovered the old trimmer and measured it with a capacitance meter. It read 2pF to 10pF. Which explains why the new 1.8 to 22pF one was so critical of adjustment.

In the end, I found that I could remove one of the fixed plates in the new trimmer to reduce its capacity slightly. This helped things considerably and I finally got the stations to line up very close to their proper positions.

After all that, the tuner sat on-station for 10 hours at a stretch, with no sign of drift. I think I can safely pronounce the job done. But I can't imagine why Philips Service couldn't have done that for the owners nine years ago!

As a matter of interest, I set the faulty trimmer in the capacitance meter and adjusted it to about 6pF, then left the meter switched on for a couple of hours. The reading remained stable for an hour or so, then began to flicker towards 5pF, then to 4pF and so on. It finally settled on 3pF. But a touch with the freezer saw it shoot back up to 6pF.

There was one thing that was rather strange though. If I turned the meter off between readings, the capacitance value never varied. It only changed while the trimmer was being subjected to an alternating voltage. It was also quite insensitive to heat applied externally, although cooling it produced a dramatic change.

So there you are. Would you have found that one?

Resurrection job

Now we come to an interesting story from Gerry Stanley, of Wahroonga in NSW. Actually, Gerry's tale contains two stories, although he only completes one of them. Here's what he has to say...

The old oscilloscope had seen many years of hard work and had been replaced with a more modern scope long before it came my way. It is a 'Telequipment SERVISCOPE', type S31, a venerable old valve unit of about 1960 vintage.

The story started when I built a new hifi amplifier, using one of those monolithic blocks of wondrous performance. When the time came for testing, the new amp was powered up and assorted test gear was connected to measure the performance.

However, there were multiple sinewave traces running back and forth across the CRO screen and nothing I could do would give a clean, single trace. It seemed obviously a fault in the CRO, so it was put aside for later attention.

When the day finally arrived, it was with a certain degree of fear and trepidation. I removed the covers from the CRO to reveal a collection of valves and electrolytic capacitors on one side of a centrally mounted vertical steel chassis. On the other side capacitors and resistors were soldered point to point from valve socket to valve socket, as was the custom in those days.

The sight of all this complication called for some distraction whilst I worked, so the Sony ICF7600 radio was switched on. I made a quick search of the shortwave bands for something interesting to listen to, but all I found were great bands of noise which seemed to come from the power mains (the Sony was running on batteries).

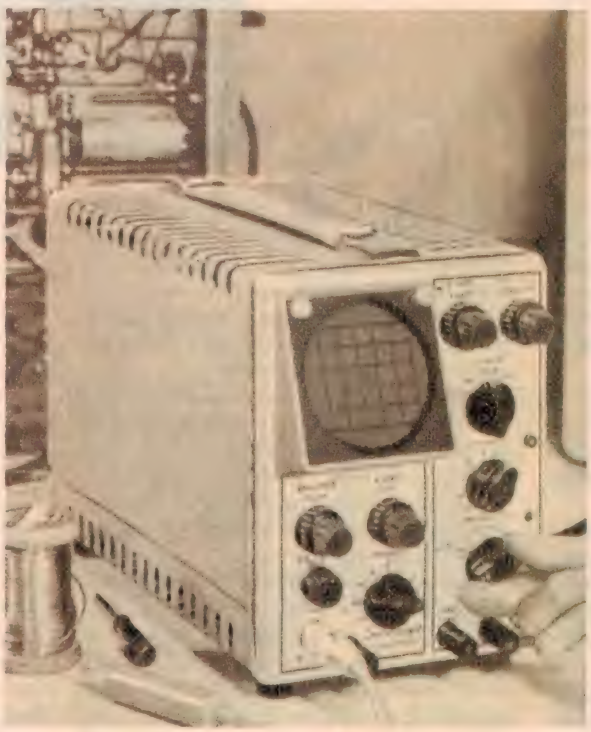
On closer examination, the worst noise came from the brick wall just beside the mains GPO. On the far side of the wall was a small bar fridge, plugged in but switched off. When approached with the Sony this seemed to be the source of the noise. But how?

The plug was pulled and the noise vanished, as if by magic. In disbelief, I reinserted the plug and there was the noise again. I went around the house testing everything that could be plugged in but always with the same result. Finally, the culprit was found — a bedside lamp with a touch sensitive switch!

With this removed the Sony was quiet and the CRO now worked tolerably well, producing a single trace that would lock to a degree. But obviously it still needed some attention.

Three of the horizontal sweep speeds were non functional and the horizontal linearity was badly out of tolerance. Examination of the circuit diagram suggested that the bottom three resistors (R73, 74 & 78) of the attenuator in the timebase and horizontal amplifier could be open circuit. And this was soon found to be so.

By unsoldering a few components, it was possible to remove the attenuator switch with the resistor chain in place. As 12M and 4M resistors were not easily to hand, they were made up of series pairs and it became a tight squeeze to get it all back together.



What the Telequipment Serviscope S31 CRO looked like when new, taken from an advertisement of the early 1960s.

With the switch reinstalled, the horizontal functions were restored and attention turned to the power supply.

The CRO was switched on and all the high tension voltages were checked against those given in the manual. Without exception, they were all wrong — mostly too high. Then I read the small print, which said '...measured with an AVO Model 8...' Then the penny dropped, and I put away my you-beaut digital meter. An old analog meter gave much more realistic readings.

A little exploration revealed that the electrolytic capacitors were all in a bad way. Most were bulging or cracked at the ends, and others had dried out to zero capacitance. Replacement high voltage electros are getting hard to find these days, but in due course they were all obtained and the task of replacing the old ones was begun.

Two capacitors were duplex chassis-mount types (C41 and 42), and I could only buy individual axial types. To make a neat and safe job of replacing them required the construction of new cans from sheet aluminium.

Two of the remaining electros were soldered on the underside of a large double-edged tagboard mounted in the center of the works. To get this out proved to be quite difficult. It requied unsoldering 30-odd connections, many with multiple wires to each large brass termination post.

A larger than usual soldering iron was needed to supply enough heat to undo some of these terminations, so the old 60-watter was dragged out of retirement. Each wire had to be labelled to ensure its correct replacement.

When finished, the CRO was fired up again and it worked, better than before. But a few of the voltages were still wrong.

A check revealed that one of the voltage dropper resistances (R108) was the wrong value, being 5k instead of 7.5k. Since it was one of three unusual chassis mounting types, I suspect that it had always been incorrect. This was replaced with the correct value and the three positive high voltages were then correct.

The two negative HT voltages were still far too low, at -390V and -800V instead of -410V and -1200V. The three selenium rectifiers, long pencil-like devices (MR1, 2 and 3) were checked. They measured something like 20 megohms in each direction, so they were replaced with 1N4007 diodes, after which all the voltages came up spot-on.

All that remained to do was to go over all the adjustments according to the manual. So the trace was recentred, the linearity adjusted and the trigger point reset, after which the old instrument worked almost like a new one.

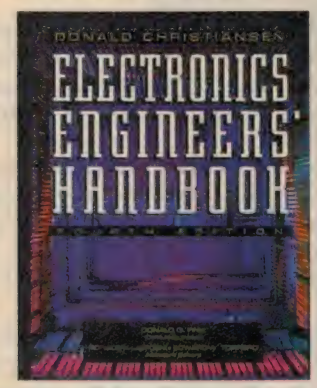
Thanks for that story, Gerry. It just goes to show that some TLC can restore the most rundown equipment. Much of this old test gear is well worth restoration, particularly if you have work for it within its capabilities. The old Telequipment scope is ideal for audio work in amplifiers, tape decks etc. Why pay for 20MHz when 6MHz or so is quite adequate?

The only disappointment with Gerry's story was that we didn't find out what was wrong with the touch-switch bed lamp. Solving that one might have made a good story. How about it, Gerry? ❖

New Books

Weighty reference

ELECTRONICS ENGINEERS' HANDBOOK, Fourth Edition. Editor in Chief Donald Christiansen. McGraw-Hill, 1997. Hard covers, 243 x 193mm, 2400 pages. ISBN 0-07-021077-2. RRP $240.



The latest edition of this weighty and highly respected handbook, and it's been fully revised and updated — what a mammoth task! No wonder editor-in-chief Donald Christiansen needed a fair bit of assistance, including some from the late Donald Fink — founding editor of the first edition of the Handbook back in 1975, and joint editor of the later editions with Mr Christiansen. Both of them have been very active in the IEEE, and both also worked for many years on the highly respected McGraw-Hill US magazine *Electronics*.

Even more so than with the earlier editions, it's an incredibly thorough, detailed and informative reference for the working engineer, written *by* a raft of experienced engineers. It literally covers just about every possible area of electronics, and in a manner which is very satisfying — the modern-day equivalent of Langford-Smith's *Radiotron Designers Handbook* and Terman's classic books, if ever there was one.

Added for this edition are sections on CAD, ICs, computers and microprocessors, digital filtering, LEDs and semiconductor lasers, medical electronics systems, and modern engineering resources such as the World Wide Web.

There are now 31 chapters in all, spread over an enormous 2400 pages, and as before they each end with a hefty bibliography, to assist with further reading. Whew!

It's quite a monster, to be sure, and for most people the price is also going to be pretty daunting. But if you're *really* serious about electronics as a profession and career, it's certainly going to be about the best reference you could invest in.

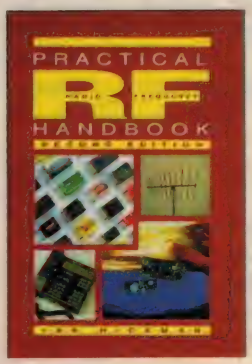
The review copy came from McGraw-Hill Book Company Australia, of PO Box 239, Roseville 2069. (J.R.)

RF design guide

PRACTICAL RADIO FREQUENCY HANDBOOK, Second Edition, by Ian Hickman. Newnes (Butterworth-Heinemann), 1997. Soft covers, 235 x 157mm, 302 pages. ISBN 0-7506-3447-2. RRP $55.

The second edition of this sound but down to earth handbook, which as the author explains is not meant to be a textbook, but rather a practical guide to RF circuit design, construction, evaluation and operation. The name Ian Hickman will no doubt be familiar to readers who also read the venerable and highly respected British magazine *Electronics World*, to which he regularly contributes articles on RF and analog circuit design.

The book is intended for almost anyone seriously interested in RF technology, from practising engineers and technicians to radio amateurs and hobby enthusiasts. It covers most topics, from basic component theory through RF transmission lines and transform-



ers, couplers, active devices, small-signal and power amplifiers, oscillators, modulation and demodulation, transmitters and receivers, propagation, antennas, attenuators and equalisers, and finally measurements. At the back there's some 14 data appendices, dealing with all kinds of things like S parameters, RF cables, quartz crystals and screening.

It's all presented in a clear and concise manner, and with a minimum of maths; the emphasis is on conveying the concepts rather than getting bogged down in the details.

Overall I found it makes informative reading, and I believe it would make a good introduction to RF technology, especially for students and new graduates.

The review copy came from Butterworth-Heinemann Australia, of PO Box 251, Port Melbourne 3207. (J.R.)

Basic textbook

ELECTRICAL PRINCIPLES 2, by Peter Phillips. Nelson ITP, 1997. Soft covers, 225 x 179mm, 272 pages. ISBN 0-17-009213-5. RRP $26.95.

Yet another textbook written by Peter Phillips, who is well known to *EA* readers from his many contributed articles, along with his monthly Information Centre col-

umn. Peter is of course also an experienced technical teacher, and has written many textbooks on electronics and allied subjects — some of which have won industry awards for their clarity and exposition.

This new text covers the content of TAFE national module Electrical Principles 2, and is written primarily for students in the relevant electrical and electronics courses. However because it covers many of the important basic concepts, it should be of value to almost anyone wanting a good grounding in the topic concerned. These include electromagnetism, electromagnetic induction, capacitance and capacitors, time constants, AC fundamentals, the oscilloscope, series L-R and R-C and parallel AC circuits, AC power and transformers, and the basics of testing and measurement.

As with Peter's other textbooks, it's all presented very clearly and accessibly, with many helpful illustrations which are well integrated with the text. An excellent approach, and the more impressive because I know Peter did the lot himself — not only wrote the text, but also drew the illustrations and DTP'd it all together as well. Top job, mate, and I wouldn't be surprised if this one wins you *another* award...

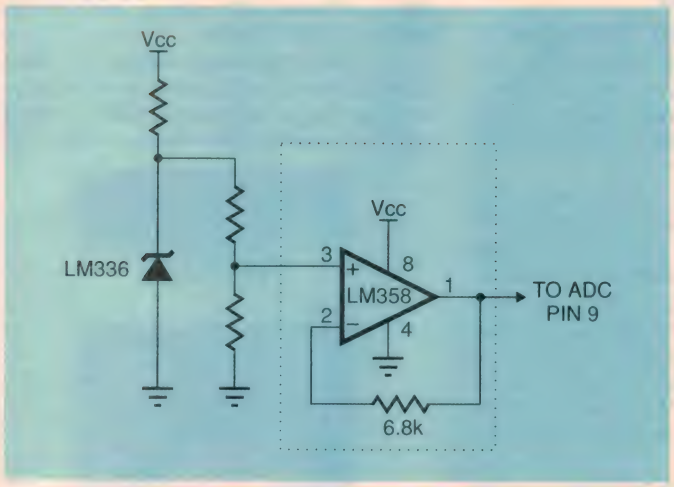
I'm sure anyone who wants a good text on the topics concerned will find it very readable and helpful.

The review copy came from publisher Nelson ITP, of 102 Dodds Street, South Melbourne 3205. (J.R.) ❖

Circuit & Design Ideas

Interesting original circuit ideas and design tips from readers. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

Simple V-ref for Pocket Sampler



Having to recalibrate the Pocket Sampler when it is used with a different computer is an inconvenience. Accurately setting the pot each time is slow and not as easy as it sounds. A good way of eliminating the calibration by using a different voltage reference was recently suggested in this column. Unfortunately, this method resulted in a reference voltage that is no longer 1V, and so the output readings require scaling before use.

The following solution was outlined in the original article and is so effective that I am surprised it was not implemented. An op-amp buffers the 1V output derived from the 2.5V reference. The buffered reference is applied directly to the ADC. A 741 op-amp was tried initially and works well at a supply voltage of about 4 volts and above (which is not available reliably from most PCs).

An LM358 op-amp, floating above the PCB on a 1cm square of matrix board by its flying leads, provides a rock-steady 0.99V until the supply voltage is reduced to about 2.6V, at which point the LM336 2.5V reference is not functional. The existing calibrate switch, R8 and VR1 are all removed.

All connections to the op-amp go by flying leads to now-vacant holes on the board. A 6.8k resistor joins pins 1 and 2 of the LM358. Pin 1, the output, is wired to the tap of VR1. Pin 3 goes to hole 3 (previously occupied by the calibrate switch) nearest R8, and holes 1 and 2 are joined. Pin 8 (+) goes to the positive end of R8 and pin 4 (-) to the negative end of VR1.

I value the better graphical resolution provided by additional voltage ranges and have adopted 20V, 8V and 2V ranges using a three-way switch for the voltage divider. The junction of the existing 75k and 15k input resistors provides the 8V tap. The automatic range sensing provided by switch 1b can now be used only for the 2V range, but I specify the other ranges in the name of the saved file.

A six-way rotary switch could provide 40V, 20V, 12V, 8V, 5V and 2V ranges at the expense of a larger box. Metal film resisters mounted on the switch provide readings well within 1%. Their values are 60k (120k//120k), 15k, 8k2, 6k8, 5k (10k//10k) and 5k.

John Crichton
Orange, NSW **$35**

40109 based Schmitt trigger

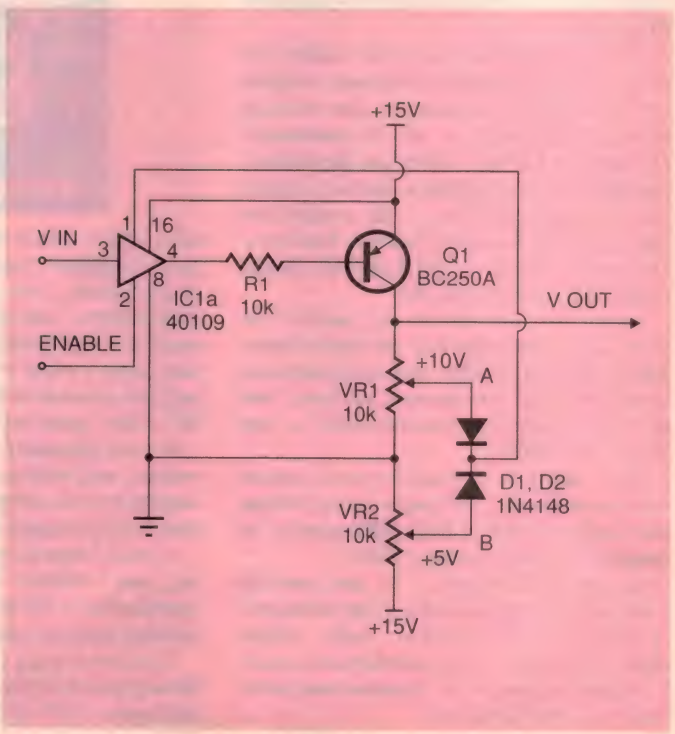
Schmitt triggers such as the 4093, etc. are widely used in electronic practice, but these triggers usually have fixed thresholds determined by the IC's supply voltage. Sometimes however it is possible to use a level shifter such as the 40109 as a Schmitt trigger with inversion, as I've done here. The circuit offered gives the opportunity to adjust the high and low trigger thresholds separately.

When Vin is equal to 0V, pin 4 of IC1a is low thus switching on transistor Q1. The output voltage (Vout) in this case is equal to +15V. If pots R1 and R2 are adjusted to ensure +10V and +5V at the points A and B respectively then the chip's input supply rail (pin 1) is equal to +10V (diode D1 is biased forward, while D2 is reverse biased).

As the input voltage of IC1a (pin 3) rises to approximately +10V/2 = +5V, the output of IC1a (pin 4) goes high thus switching off transistor Q1. The output voltage Vout goes low, which reverse biases D1 and allows D2 to conduct. Pin 1's voltage then becomes equal to +5V, so when the voltage of pin 3 falls to approximately +5/2 = +2.5V, pin 4 goes low again switching on the transistor.

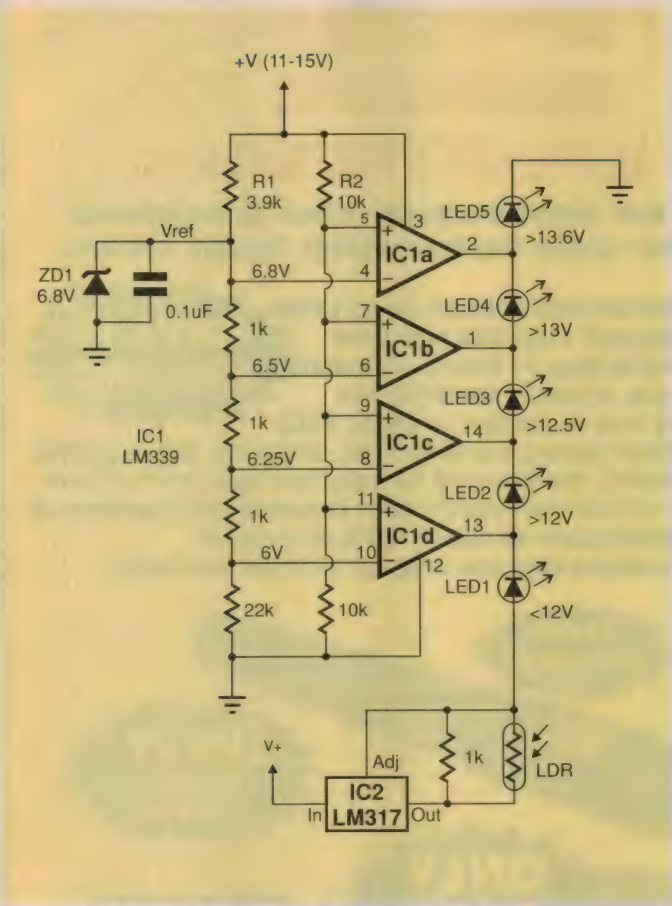
I've been describing this in a rather simplistic way, and have ignored the voltage drops of the switched on transistor, as well as the forward biased diodes D1 and D2. The two pots VR1 and VR2 adjust the high and low thresholds respectively, and these can be trimmed to compensate.

V.B. Oleinik
Koroliov, Moscow, Russia **$35**



As an added incentive for readers to contribute interesting ideas to this column, the idea we judge most interesting each month now wins its contributor an exciting prize, in addition to the usual fee. The prize is a complete closed circuit TV system, comprising a 5" B&W video monitor, CCD video camera with stand, power supply and cabling. This system comes from our sponsor Allthings Sales & Services, and is valued at $369.00!

Win our 'IDEA OF THE MONTH' Prize!



Low power bargraph voltmeter for cars

This car voltmeter is easy to read, simple to build and offers an expanded scale that can be altered to cover a minimum of 11.5V.

R1 and ZD1 apply a reference voltage of approximately 6.8V to the inverting input of IC1a (pin 4). By further division via a resistive voltage divider IC1b, c, and d are biased to 6.5, 6.25 and 6 volts respectively.

The non-inverting inputs are held at half the battery voltage via two 10k resistors. When the battery voltage is higher than 13.6V, all non-inverting inputs sit higher than their reference voltages, and so all their open-collector outputs are floating. The string of LEDs connected across the outputs is current sourced by IC2 and so all the LEDs light up. Since they are all in series (with a maximum voltage drop of 9.5V) one current supplies all.

As the battery voltage falls, the output of IC1a goes low first, shunting LED5 to ground. So one LED after the other goes out in sequence with falling battery voltage until it falls below 12V, and only LED1 remains lit, with LEDs 2-5 shunted to ground.

In total darkness the LED current is only 1.3mA since IC2 maintains a constant 1.25V between its output and adjustment terminals, across the 1k resistor. But when bright ambient light falls on the LDR in parallel, its resistance drops down to as low as 100Ω, increasing the current to the LEDs to almost 13mA. Total consumption is about 4mA in darkness and less than 14mA in daylight regardless of the battery voltage and the number of LEDs turned on. If R2 is replaced by a 9.1k plus a 2k trimpot, the metering range can be shifted by +/-6V. Also by replacing the 22k resistor with an 18k resistor plus a 5k trimmer the range can be stretched (expanded) down to 11.5V.

Manfred Schmidt
Edgewater, WA **$30**

ESR meter measures batteries, too

Bob Parker's excellent ESR meter (January 1996) will also test all types of cells and batteries. Used in the normal way, a cell's 'effective series resistance' shows on the meter's display, indicating its ability to deliver current and voltage regulation. All cells have an ESR characteristic of cell type, size and state of charge. For cells of the same size, NiCads have the lowest ESR, followed by alkaline, Ni-MH, carbon-zinc and others.

Flat and faulty cells will have high ESRs. A dry cell's ESR increases as it is used, going high when flat. A rechargeable cell or pack can be measured while on charge or load, provided the current is steady. Even the tiniest button cells may be checked, as there is no load current.

A high ESR reading may reveal damaged cells or a bad internal connection. All tests are instant and require no other equipment. Checking and matching new cells is another application; the table of typical readings for good cells will help get you started, until you create your own database.

Phil Allison
Sydney, NSW **$35**

THIS MONTH'S WINNER!

	AA	9V	12V AA pack	7.2V sub-C
NiCad	0.03	-	0.5 welded	0.11 welded
Alk	0.12	0.8	1.5 spring	-
Ni-MH	0.35	-	4.0 welded	-
C/Zn	0.45	10	5.1 spring	-

Jaycar ELECTRONICS

MAY SALE

Prices valid until May 31st.

All prices in Australian Dollars - New Zealand customers please ask for New Zealand prices.

VULKAN

PROFESSIONAL GAS SOLDERING TOOL BREAKTHROUGH!!!

Jaycar Electronics is proud to announce the exciting release of a new name in the Gas Soldering Tool field.

The Vulkan cordless gas soldering iron and precision heating tool delivers up to 135W of output. Its made of lightweight plastic, and weighs just 110g. The tool uses catalytic conversion for most of its applications, delivering heat to the tip by means of infrared radiation. The fuel is standard butane gas, which is stored in the translucent handle, simply hold up to the light to see how much fuel remains. Each refill provides up to 3 hours of continuous use at a typical setting for electronic soldering. Gas is ignited using a piezo electric spark from crystal inside the casing. Gas flow can be adjusted from 400 to 1,200 degrees celcius. Except for the blow torch, all tips use a platimun catalyst that converts the gas flame to infrared radiation once the "light off" temperature of about 130°C is reached.

MADE IN IRELAND

Vulkan Tools are made in Ireland, the very same country that the original Portasol was made.

VULKAN

PROFESSIONAL

FEATURES:
- Piezo electric ignition
- Gas catalytic heat source
- Adjustable heat output
- Equivalent of 20 to 135 watts
- Gas refills last up to 180 minutes
- Translucent gas tank for visible fill level
- Temperature range 400°C to 1,200°C
- Includes the tool, cap and 2.4mm chisel tip

Cat. TS-1200

1Year Warranty

ONLY $89

PROFESSIONAL TOOL KIT

THIS KIT INCLUDES THE SAME TOOL AS THE TS-1200 WITH THE FOLLOWING ADDITIONS:
- Quality plastic case
- Stand
- Flame tip
- Hot blow tip
- Deflector for hot blow tip
- Hot knife tip
- Cleaning sponge
- 2 metal storage trays for hot tips
- Cap and 2.4mm solder tip

Cat. TS-1205

ONLY $129

VULKAN

TIPS & ACCESSORIES TO SUIT VULKAN PROFESSIONAL

1mm Chisel Tip	TS-1209	$19.95
2.4mm Chisel Tip	TS-1210	$19.95
3.2mm Chisel Tip	TS-1212	$19.95
1mm Angle Tip	TS-1214	$19.95
2.4mm Angle Tip	TS-1215	$19.95
Hot Knife Tip	TS-1216	$19.95
Hot Air Blow Tip	TS-1217	$19.95
Deflector For Hot Blow	TS-1218	$12.95
Flame Tip	TS-1219	$14.95
Stand Suits TS1200	TS-1208	$6.95

HALOGEN GARDEN LIGHT FITTING

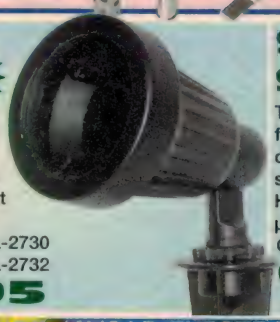
IT'S NEW

This low voltage landscape light increases security around the house as well as lighting up your garden. It is made of diecast aluminium and is black powder coated. It includes a ground spike and is waterproof. Use 12V halogen lamps in 20W or 50W. (not supplied) Use the following lamps ($4.95 ea):

20W 12° 12V Cat. SL-2729
20W 38° 12V Cat. SL-2730
50W 12° 12V Cat. SL-2731
50W 38° 12V Cat. SL-2732

Cat. SL-2758

$19.95



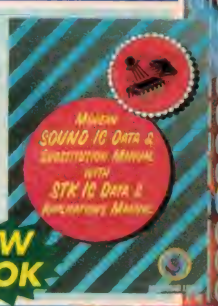
SOUND IC DATA & SUBSTITUTION MANUAL

This brand new book lists data, substitutions and functions, as well as a drawing and block diagram on over 600 commonly used audio IC's. Prefixes of some of the types listed include AN, BA, CX, CXA, HA, KA, LA, LB, LM, NE, SA, TA, TBA, TDA, TEA, µPC, STK. Softcover 148 x 210mm. 548 pages.

Cat. BM-4588

Only $29.95

NEW BOOK



NEW TELEPHONE DOUBLE ADAPTORS

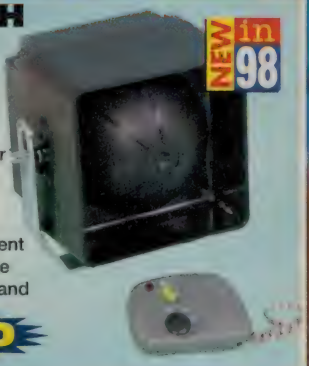
NEW in 98

AUSTRALIAN PLUG TO 1 X AUSTRALIAN SOCKET & 1 X US SOCKET
Cat. YT-6024
$7.95

AUSTRALIAN PLUG TO 2 X US SOCKETS
Cat. YT-6022
$7.95

ALL IN ONE CAR ALARM WITH LEARNING REMOTE

NEW in 98



A great new alarm thats both simple to use and install - just two wires to connect (power and ground!) or three wires with the use of an optional tamper switch! Sensing is handled by an inbuilt vibration sensor which you can adjust in sensitivity via the remote control. Other features include: •5 selectable siren tones, selectable via the remote control •Optional door/bonnet switches can be connected •Single button arm/disarm/panic •Shock sensor warning tone •Arm/disarm verification tones •Panic button •Code learning remote controls •Current sensing input also available. Supplied with alarm/siren unit, one remote control transmitter, mounting bracket, 2 x warning stickers, hardware and operating instructions. Cat. LA-8980

Spare Remote Cat. LA-8982 $19.95

$89.50

ALARM SYSTEMS 4 SECTOR WIRELESS HOME ALARM SYSTEM

Wireless alarms are particularly convenient to people who rent their home or who move around on a fairly regular basis, and being wireless, the alarm can be packed away with very little fuss and installed in a new location. System includes: •Control panel •1 remote •1 PIR •1 reed / magnet transmitter •1 power supply.

Cat. LA-5490 **$329.50**

EXTRAS AVAILABLE

NEW in 98

PIR Cat. LA-5491 $79.50
REMOTE CONTROL Cat. LA-5492 $42.95
REED SWITCH Cat. LA-5493 $47.95

FIXED GEARBOX WITH MOTOR

NEW in 98

Replacement motor for toys or experimenters. Specifications: •1.5V to 3VDC •6650 rpm •6.4g / cm torque •Gearbox ratio, 233:1 •2.5mm drive shaft diam. 100mm length.

Cat. YG-2725 **$6.95**

"SERIOUS" RECHARGEABLE LANTERN TORCH

NEW in 98

Kit includes the torch (with krypton globe and tilt stand), 6 volt SLA rechargeable battery, 240V automatic charger and 2 alligator clips (which need soldering to charge leads). Separately cost for components is $75.85. (Torch available separately $14.95 Cat. ST-3080

Cat ST-3081 **$59.95**

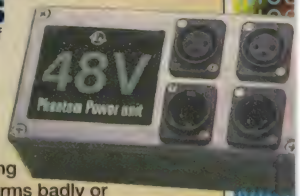
NEW KITS

THE SUPER EAR KIT

REFER: EA MAY 1998
There are zillions of sounds out there - if only you could hear them! This kit lets you hear more than you could with your normal unaided ear - particularly higher frequencies which are often the quietest. Build this kit and experience a whole range of unexplored sounds. Kit includes case, PCB, hardware plus specified components. 9V battery and IC socket also included.

Cat. KA-1808 **$23.95**

PHANTOM POWER SUPPLY KIT FOR MICS & DI BOXES



REFER: EA MAY 1998 There are a number of situations where this phantom supply will help produce a superior and more reliable quality of sound in both recordings and PA systems. First, home studios or 4-tracks generally don't have phantom power to use quality condenser mics; many older PA mixing desks have phantom power that either performs badly or doesn't work at all. Kit is supplied short form with PCB, transformer plus all specified electronic components. Refer to our 98 Catalogue for our range of suitable XLR connectors and enclosures to suit your personal requirements.

Cat. KA-1809 **$19.95**

12V/9W FLUORESCENT OUTDOOR HAND LIGHT

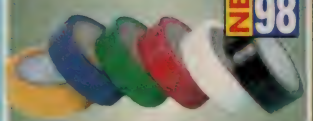
NEW in 98

This low voltage light features a spring return wind-up extension lead of approx 5.5m. The twin-tube fluoro itself is housed inside a weatherproof tube measuring 330mm long. The tube features a steel clip to hang the light up if need be, and a cigarette lighter plug.

Cat. ST-3032 **$49.95**

6 ROLLS INSULATION TAPE

NEW in 98



One roll each of green, black, yellow, white, blue and red, each 15mm wide, 4.5 metres in length. A handy pack to keep in the toolbox or glovebox.

Cat. NM-2806 **$2.75**

DSC 5 SECTOR ALARM DEAL

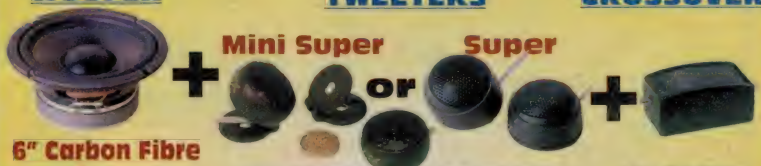
This system includes the DSC 5 sector alarm panel with Austel Approved dialler. Connect it to an alarm company or it can phone you or your neighbours etc.

INCLUDES: (NORMAL PRICE)
1 x DSC 5 zone alarm/dialler $285.00 •3 x Pulse PIRs $104.85 •1 x mains 3 wire power supply $24.95 •1 x 7.0Ah backup battery $39.95 •2 x reed/magnet switches $11.90 •1 x strobe $19.95 •1 x metal siren cover $29.95 •1 x siren horn $23.95 •1 x internal siren $19.95 •2 x deterrent stickers $4.00 •100 m of 6 core alarm cable $88.00

NORMALLY PAY $652.45
SAVE $53.45
Cat. LA-5460 **$599**

SPLIT CAR SPEAKER DEAL

WOOFER + TWEETERS (Mini Super or Super) + CROSSOVER



6" Carbon Fibre RESPONSE
Cat. CS-2240

Cat. CS-2205 Cat. CS-2210 Cat. CX-2640

GREAT VALUE

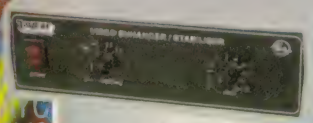
WOOFERS	$155.90 Pr
TWEETERS	$65.00 Pr
CROSSOVERS	$9.95 Pr
ALL THREE	$230.85 Set

GRILLS TO SUIT WOOFERS $8.95 each. Cat. AX-3518

BUY TOGETHER FOR $199.95 SET

OVERNIGHT DELIVERY*

VIDEO ENHANCER / STABILISER KIT



Refer: E A Nov. 1997
This kit will give you better quality copies when you dub from one video tape to another. See 98 Cat. page 3 for details.

NEW in 98

Cat. KA-1798 **$69.95**

*OVERNIGHT DELIVERY

AVAILABLE ON REQUEST
Subject to conditions:
- Max weight 3KG (inc cubic) $10
- No dangerous goods
- Max weight 5kg (inc cubic) $16
- Stock & availablity
- Orders must be received before midday E.S.T.

12V/55W FOG/SPOT DRIVING LIGHTS

NEW in 98

These lights measure approx. 65mm x 85mm, making them perfect optical lens for producing a powerful light beam. Each light is mounted on a swivel base suitable for mounting under a bumper bar or spoiler. Also included is an attractive dash-mount pushbutton switch which has a red and green LED behind a dark translucent housing, to indicate power status. Supplied absolutely complete with wiring loom, 12V relay, mounting hardware cable ties, hex key for light adjustment, dash switch and two driving lights.

Cat. ST-3070 **$79.95**

AUDIO VIDEO UHF TRANSMITTER

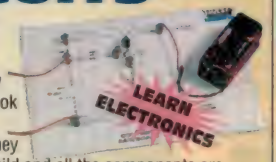
NEW in 98

Watch videos on a second television without running cables from one room to another. This video sender plugs into your VCR and will transmit a quality AV signal to any UHF TV within 5-10 metres. Features solid metal case with non slip rubber feet, telescopic antenna, power indicator, gold RCA sockets, adjustable input gain and channel fine tuning.

Cat. AV-6505 **$79.95**

SHORT CIRCUITS

IDEAL FOR KIDS!!!



Short Circuits assumes they know nothing about electronics. The book shows you what electronic components look like and how they work. There are 21 projects to build and all the components are supplied to build all the projects. There is no soldering required and all components are mounted on a baseboard with springs. Some projects are: •Short circuit tester •Police siren •Sound effects •Light chaser •Solar powered radio •Amplfier •Buzzboard & more.

SHORT CIRCUIT BOOK & PROJECT KIT

Cat. KJ-8502 **$29.95** *Used In Schools

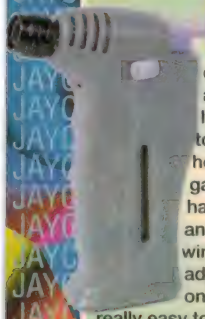
12V/7W COMPACT FLUORESCENT CAMPING LIGHT

NEW in 98

Ideal for camping. Includes 7W compact fluro tube, 2-8mt. power lead to cigarette lighter plug.

Cat. ST-3018 **$29.95**

MINI GAS TORCH



NEW in 98

This unit is gas fillable, rather cheaper than using a cigarette lighter. It's much cheaper to operate and holds much more gas than a lighter. It has piezo ignition and will ignite in the wind. It has a flame adjuster and an on/off switch, and is really easy to fill with gas. Height 110mm. Use Jaycar gas (NA-1020)

Cat. TS-1682 **$19.95**

VOICE RECORDERS

NEW in 98

8 SECOND
Cat. XC-0272
$14.95

20 SECOND
See 98 Cat. page 205 for details.Cat. XC-0275
$24.95

12V ILLUMINATED PRO AUTO SWITCH

Consists of a SPST light action push button on/off switch, with one red (on) and one green (off) LED. The switch housing is a dark translucent plastic that looks great on any dashboard or control panel.
Use this switch to control a relay or other 12V solid state device. Needs a relay to function (e.g. SY-4068).

NEW in 98

Cat. SP-0740 **$12.95**

ENTRY ANNOUNCEMENT DEVICE ALARM / DOORBELL

NEW in 98

Mini sized entry announcer, plus a door bell can be hard wired. See 98 Cat. page 81 for details.

Cat. LA-5175 **ONLY $39.95**

EXTREMELY LARGE LCD DIGITAL CLOCK WITH CALENDAR AND TEMPERATURE

NEW in 98

This must be the largest LCD clock we have ever seen! Ideal for warehouses, factories, offices and home etc. Includes: •Temperature readout in C or F •Calendar with day, date and month display. •12 or 24 hour time •Huge 152 x 94 LCD display with actual time digits 55mm high •Total size 210(w) x 230(h) x 25(d)mm.

Operates from 2 x AA batteries. Cat. XC-0230 **only $89.95**

CAPACITOR MADNESS 10,000UF 100V CAN ELECTRO

Ripple current 8.1A. Cat. RU-6712
1997 Price $39.95
May 1998 $25
Save $14.95

WIRE MANAGER

This device is a length of flexible corrugated conduit which is split lengthwise. You use it to trunk all cables leading to and from equipment into one neat bundle which fits inside the conduit. Cables that branch off simply exit from the slit! Also included in the kit are wire ties and special coloured labels to enable you to keep track of individual leads once the whole lot is bundled up! Conduit is grey in colour, 2m long and 22mm dia. (expandable).

NEW in 98

Cat. HP-1230 **Was $19.95**
May $14.95 Save $5

CCD DOME CAMERA

NEW in 98

The black and white CCD camera is mounted in a black dome, & is ideal for mounting on a ceiling or wall. The dome is small in size, having a dia. of 87mm, Supplied with short lead (160mm) with BNC socket for video signal and DC socket for power (12V).

Cat. QC-3472 **$139**

JAYCAR WHOLESALE (02) 9743-5222

MAIL ORDER - FREECALL FOR PHONE ORDERS 1800 022 888

OVERNIGHT DELIVERY*

PRICE BREAKTHROUGH

DUOTECTOR BURGLAR ALARM PIR/MICROWAVE DETECTOR

We sold these high Quality Japanese detectors in 1996 for $99.95 and have secured a limited quantity of 10 and 15 metre-range units for a fraction of their 1996 sale price. For the unit to trigger an alarm, both the PIR and microwave detectors must be triggered at the same time - substantially reducing the chance of false triggering. Two models are available, a 10 metre range for domestic security and a 15 metre range for warehouse and halls where a long narrow beam is required.

NEW in 98

MADE IN JAPAN

10 METRE LONG RANGE Cat. LA-5012 **$69.50**

15 METRE LONG RANGE Cat. LA-5013 **$79.50**

TALKING CALCULATOR / ALARM CLOCK

A 10-digit LCD full-featured calculator with clear digitised speech! Features: •Time •Data •Alarm •Adjustable volume switching between spoken units or individual digits (i.e. "eight-seven-five" or "eight hundred and seventy five"). This unique calculator includes soft rubber buttons and requires 2 x AAA batteries - not included, use our SB-2426.

NEW in 98

Cat. QM-7276 **$29.95**

JC25 Bookshelf Speaker Kit

NEW in 98

Refer: EA March 1998 , and the Jaycar 1998 Catalogue page 43 for full details.

SPEAKER KIT: Pair Cat. CS-2585 **$169 Pr**

Consists of: •2 x 5" Re/Sponse polypropylene woofers •2 x Vifa D19 dome tweeters •2 x pre-built crossovers with rear terminals •Jaybond speaker lining material •4 x bass reflex ports •mounting hardware & internal cable.

CABINET KIT: Pair Cat. CS-2586 **$199 Pr**

Consists of two pre-built cabinets constructed of high quality MDF and finished in black-grey oak. Size 187(W) x 197(D) x 287(H)mm. Speaker grille cloth pre-mounted on removeable frames.

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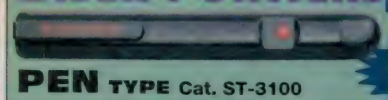

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Construction Project

THE SUPER EAR

There are a zillion sounds out there, if only you could hear them. With the Super Ear you'll be able hear a lot more than you can with your normal unaided ear — particularly the higher frequencies, which are often the quietest (especially when you're getting on a bit). Whether you're a little lacking in the higher audio ranges or you just want to explore a whole range of other sounds, the Super Ear is a fun little project to build.

by GRAHAM CATTLEY

This project was originally designed to help people who have difficulty in hearing higher audio frequencies; it's a common problem, and can be caused by anything from a noisy work environment to simply growing older.

The idea is to boost the high end of the audio spectrum, giving the Super Ear a bright clear sound that is more understandable — particularly with speech. Speech contains a large mixture of high and low frequencies, but most of the intelligence (that is, the information being transferred) is contained up in the higher frequencies. If you have difficulty in hearing in the upper end of the spectrum then speech can become 'muffled', and quite often unintelligible.

By amplifying the speech, and more importantly by boosting the higher frequencies, you'll find things can suddenly lock into place as you are now receiving enough information to follow the conversation.

The Super Ear is essentially a microphone connected to a high-gain amplifier, with a switchable filter to give an apparent boost to higher frequencies. There's also a socket which can be used to connect external microphones or pickups, but more about that later.

After building up the prototype we found that it did indeed boost the upper frequencies, but we found something else as well: a whole other world of high frequency sounds that you normally don't hear. Things like a piece of writing paper being placed on the table, a watch ticking, or simply walking across the room produce a whole range of high frequency sounds that, because of their low energy and the human ear's response, you just don't normally hear. Even one's own breathing can take on a distinctly alien sound...

There are many interesting things you can to do with the Super Ear, and I'll touch on them at the end of the article. For now though, let's see how it all works.

The Super Ear is shown here with a pair of stereo headphones. It contains a switchable filter and volume control, with the built-in microphone and external input socket mounted on the rear panel.

The circuit

You can break the Super Ear's schematic into four main sections: the input and preamplifier, a switchable filter, the main amplifier, and finally the power control. Probably the best place to start is at the beginning, so we'll look first at the input and pre-amp stage.

A normal electret microphone is used to pick up the sounds, and the level of its output signal is determined by the 2.2k dropper resistor R1. This signal passes through the switched contacts of SKT1 and is amplified by Q1, set up in a self-biasing configuration

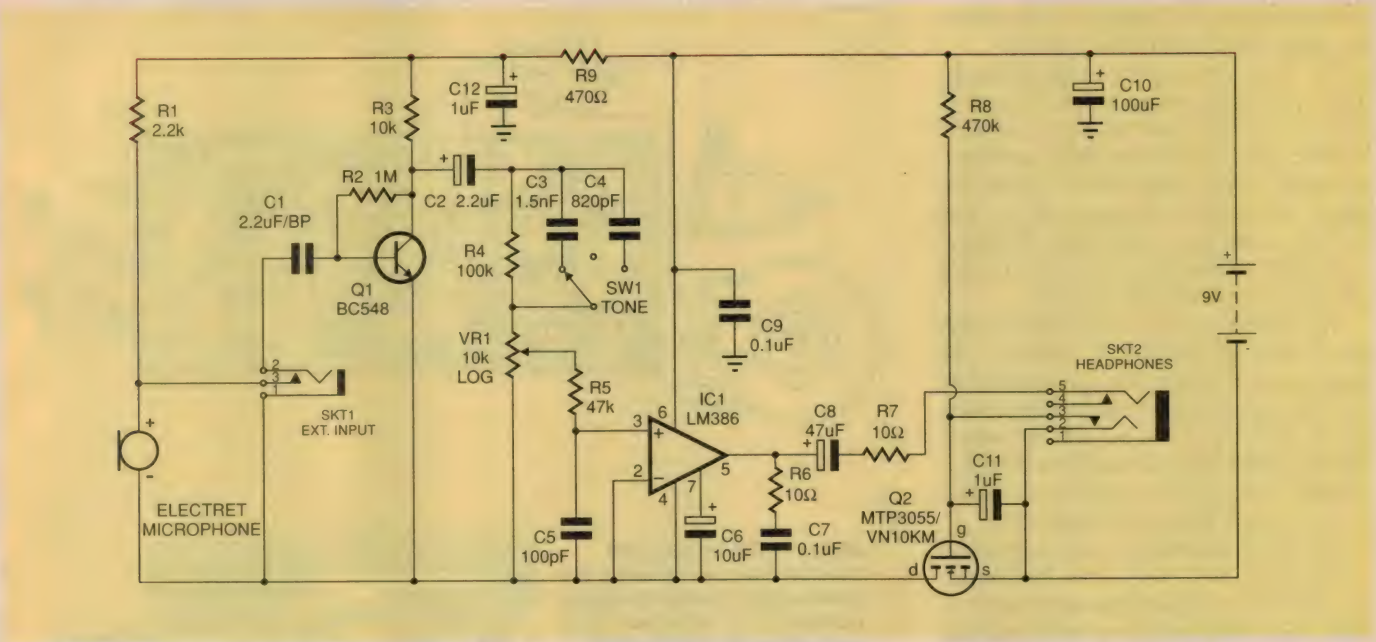


Fig.1: The Super Ear's schematic diagram. Q1 amplifies the signal from the microphone which then passes through the filter comprising R4, VR1 and C3 or C4. The values of these capacitors can be changed to provide different levels of boost at higher frequencies (see Fig.2 for some suggested values). The main amplifier (IC1) is set to give a gain of 20, with its output driving the headphones via R7 to limit the volume. The power is switched by Q2, which is turned on when the headphones are plugged in.

with R2 and R3. The external input allows you to plug in other pickups, such as a directional microphone or magnetic pickup, and in doing so disconnect the built-in microphone from the rest of the circuit.

The switchable filter is based around SW1 and the voltage divider consisting of R4 and the volume control VR1. With SW1 in its centre (off) position, the voltage divider behaves in a linear fashion with equal attenuation of all frequencies. If the switch is moved to one of its other two positions, a capacitor is switched across R4. With this capacitor across the top resistor, the voltage divider now behaves in a distinctly nonlinear fashion, allowing more of the high frequency energy through. Of course the values of the capacitors will have a significant effect on the frequencies passed, and the table in Fig.2 shows the relationship — the bigger the capacitor, the louder the higher frequencies.

The output from the filter is taken from the wiper of the pot, and is then passed through a simple RC filter to roll off the response at around 30kHz. This is well above the range of human hearing, and helps prevent the amplifier oscillating at supersonic frequencies.

The main amplifier is your good old LM386, ideal in this application as it only draws around 7-8mA in this application when running from a 9V source. It's running here with a fixed gain of 20, with capacitors C6 and C10 providing stability, along with the Zobel network R6 and C7. The output is taken via C8 and 10Ω resistor R7. This resistor limits the current through the headphones and limits the maximum power at the output to a safe level.

Headphones

The Super Ear is designed to work with any pair of stereo headphones (including the 'bolas' style in-ear phones), with both ears wired in series. This allows us to use one switching section of the socket to control the power to the Super Ear.

Here you can see the microphone and external input socket on the rear of the case. As well as external microphones, magnetic pick-ups can be used to great effect.

As you may have noticed from the photos, there isn't much room left inside the case for an on/off switch, let alone room for it on the front panel. Instead, we are using a MOSFET to control the power, and it is in turn controlled by the headphone socket SKT2. In this way, you simply plug in the headphones to turn the unit on, and remove them to turn it off again.

With the headphones removed, the MOSFET is turned off by virtue of its gate being shorted to its source. When the phones are plugged in though, the gate is pulled high by R8, and the MOSFET turns on, supplying power to the rest of the circuit. R8 is a rather high 470k because it is effectively wired across the battery when the circuit is off, and so we want a minimum of current to flow. C11 prevents any pops and crackles as the headphones are plugged in, by forcng the MOSFET to turn on slowly.

Construction

Building the Super Ear is perhaps not as straightforward as with most other small projects, in that everything must be mounted in exactly the right place — mount a switch or socket upside down and chances are that you won't get the lid on. Don't worry though; if you follow the instructions everything will fit in nicely and it's not that difficult to wire up.

Although we normally start construction with the PC board, this time I suggest that you start by mounting the microphone, switch and sockets in the ends of the case. I say this because if you elect to use the plastic panels supplied with the case, you'll find that they are too thick to accept the 3.5mm shank on the two sockets. To get around this, you have two options: either make a pair of new end panels out of blank PCB laminate or

similar material, or simply *glue* the sockets into holes drilled in the plastic panels.

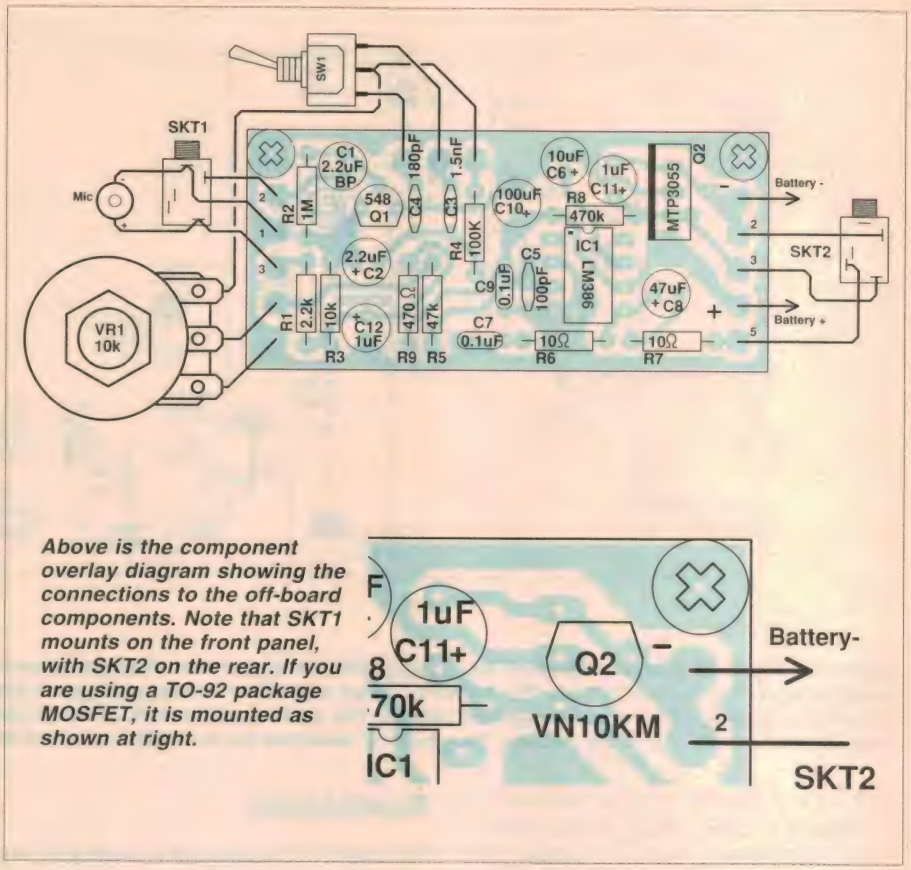
We tried both methods in the prototype, with the components mounted on the replacement front panel in the conventional manner, and both the microphone and external input socket glued into the plastic end panel with five-minute epoxy. If you glue the parts in before you start on the PC board, everything should be ready by the time you get around to wiring it all together.

Start by drilling two 6mm holes in the rear panel using the template as a guide — the actual position of these holes isn't too critical, but the template helps to keep things aligned. While you are at it, you can drill the holes in the front panel. The position of these holes *is* critical, so be sure to mark off the centres using a copy of the front panel artwork...

Glue the microphone in flush with outside of the panel, and if you've gone for the plastic panel, glue in the external input socket as well. Keep the socket's terminals pointing into the centre of the box, as you may find that they will foul against the support pillar when the wires are soldered in place. The other (headphone) socket can be mounted in a similar manner on the front panel, this time with its terminals aimed towards the outer edge of the panel. Install the switch next, and you'll see what I mean — with the socket orientated any other way, either the switch won't fit, or the socket's terminals will be inaccessible.

The last tricky bit is mounting the volume pot VR1. It will need to have its leads trimmed flush with its body in order to let it fit in the case. The best method is to keep trying the panel in the case and position the pot as necessary.

Right! You've finished the hard bit, so let's get on with the less demanding job of installing the components on the PCB. Start, as usual, with the PC pins, resistors and disc ceramics, followed by the transistor and IC1.



Above is the component overlay diagram showing the connections to the off-board components. Note that SKT1 mounts on the front panel, with SKT2 on the rear. If you are using a TO-92 package MOSFET, it is mounted as shown at right.

The seven electrolytics are next, with the MOSFET installed last of all.

You'll notice a couple of extra holes in the board, to accommodate the two different styles of MOSFET: the TO-220 MPT3055, or the smaller VN10KM in a TO-92 package. They're only passing 7-8mA so either one will do — we used a TO-220 style in the prototype as shown on the overlay, but Fig.3 shows how you can install the smaller MOSFET instead.

With the board finished, all that remains is to mount it in the box, and to wire everything up. The board is secured to the bottom of the case with a pair of short self tapping screws. If you can't find any short enough (around 3-4mm), you can do as we did and use a pair of old side cutters to trim a couple to size.

As far as wiring up the switch, pot and sockets is concerned, follow the layout in the component overlay diagram of Fig.2. Remember, though, that the headphone socket is mounted on the front panel along with the pot and switch, while the external input socket mounts at the other end of the case; so make sure that you leave the leads long enough to reach. You're best off using a short length of twin-core shielded cable between the microphone and the PC board, and don't forget the connection between the 'hot' end of the pot and the centre pole of the switch.

The battery clip leads are soldered directly onto the board, and once you have installed a 9V battery (preferably alkaline), you can screw the case together and you're finished!

Eating crisps...

Dig up a pair of headphones from somewhere, and plug them into the Super Ear. After about a second you will hear everything picked up by the microphone in a somewhat 'enhanced' form, depending on the switch and volume setting, the values for capacitors C3 and C4, and on the quality of the headphones.

PARTS LIST

Resistors

(All resistors 1/4 watt, 5%)

R1	2.2k
R2	1M
R3	10k
R4	100k
R5	47k
R6,7	10 ohms
R8	470k
R9	470 ohms
VR1	10k

Capacitors

C1	2.2uF/16V bipolar electrolytic
C2	2.2uF/16V electrolytic
C3	1.5nF disk ceramic (see Fig.2)
C4	180pF disk ceramic (see Fig.2)
C5	100pF dick ceramic
C6	10uF/16V electrolytic
C7,10	0.1uF monolithic bypass
C8	47uF/16V electrolytic
C9	100uF/16V electrolytic
C11,12	1uF/16V electrolytic

Semiconductors

IC1	LM386 power amp IC
Q1	BC548 NPN transistor or equiv.
Q2	MTP3055/VN10KM N-channel MOSFET or equiv.

Miscellaneous

VR1	10k 17mm log pot
SW1	SPDT three position toggle switch
SKT1,2	switched stereo panel mount phono sockets
MIC	electret microphone

PCB 55 x 25mm, coded 98tl05; Plastic box to suit (90 x 50 x 32); 12mm knob; 13 x PC pins; 70mm twin-core shielded cable; 100mm 12-core ribbon cable; 9V battery clip; 2 x self tapping screws to suit case, solder etc.

As well as making conversations clearer, you'll find that the Super Ear picks up a lot of other sounds that you may have never noticed before. Try listening to your own breathing, both by holding the microphone up to your mouth and then to your throat. You can listen in on the variety of squelches and gurgles in your (or someone else's) stomach, and for the ultimate in frivolity, try listening to yourself eating crisps — it's enough to put you off crunchy foods for quite a while...

Out in the garden, the Super Ear will pick up birds and insects quite well, (even snails!) and you could improve on matters by making some sort of parabolic dish to focus the sounds into the microphone.

Another option is to use a more directional microphone, which can be plugged into the external input socket, SKT1. You can also try using the Super Ear with a telephone pickup. These are available for a few dollars and allow you to hear 'sounds' in the electromagnetic spectrum. Almost all electrical and electronic equipment emit a raft of weird and wonderful tones and buzzes, and with such a sensor you can see the extent of the EM fields surrounding electronic equipment.

Fig.2: Capacitor values for C3 and C4

(With R4 equal to 100k)

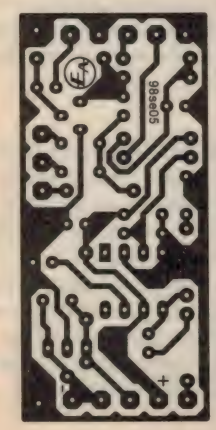
820pF	gives +3dB at 2kHz
1nF	gives +3dB at 1.7kHz
1.5nF	gives +3dB at 1kHz
2.2nF	gives +3dB at 770Hz
4.7nF	gives +3dB at 370Hz

Louder, please

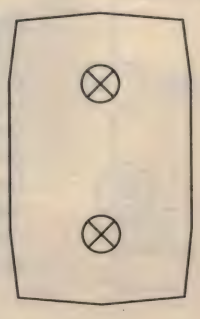
If you find that the volume is a little low, there are a few things you can do about it. Perhaps the easiest is to try using a good quality pair of in-ear earphones, the type commonly available for use with personal stereos. These give a much better coupling between the headphones and the ear, and can increase the perceived volume considerably; they are also less obtrusive.

Other than that, you can alter the value of R4. Taking this resistor down to 47k should give you a 6dB boost, but the break point of the filter will change as well. If you want to try altering this resistor, you can fiddle around with the values of C3 and C4 to get the filtering you want. You could also try increasing the value of R1 to 4.7k or 10k; this will make the built-in microphone more sensitive, but it won't affect any external input.

One small point to note is that due to the way in which the headphone socket is wired, the sound that you hear in each ear is out of phase. This is easily fixed if you find an out of phase sound uncomfortable, by re-wiring the plug on the headphones. Simply move both shield lines to the plug's ring connection, and both of the 'hot' leads to the tip — effectively wiring both phones in parallel and thus keeping them in phase. ❖



You can see in the photo above that it actually does all fit in the case! Note the length of shielded lead for the microphone. Below is all the artwork reproduced full size. Use the template (centre) to mark off the holes on the rear panel.



Not a Hearing Aid!

While the Super Ear is a interesting and fun project to use, it can also be used to assist those whose hearing is perhaps not as good as it used to be. It works well in this respect, but if you find that the Super Ear doesn't offer the level of assistance that you require, then we strongly suggest that you consult a qualified audiologist or medical practitioner. We don't intend that this device be used as an aid in cases of serious hearing loss — but it may be able to help those with a *slight* hearing problem.

$10 Wonders

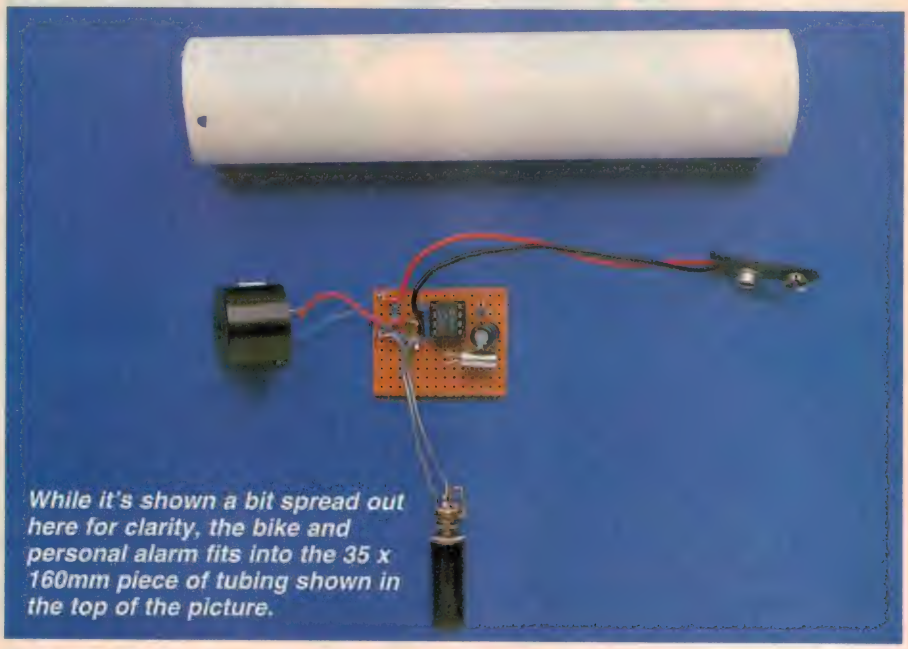
10 — Bike & personal alarm

Hands off! That's the message people will get if they try tampering with something protected with this alarm. Without a special key they'll have a very noisy alarm sounding until they leave everything as they found it, or until you arrive on the scene with your key, it's good for bicycles, books, bags and even your lunchbox...

If it is left undisturbed, this portable and rather harmless-looking device stays peacefully quiet, gently consuming only about 200uA of current. But if it is shaken, turned upside-down or otherwise disturbed, it emits an ear-piercing shriek and continues to do so until about 10 seconds after it has once more been left undisturbed and the right way up.

As a bike alarm, you can fix it to the frame or carry it in a saddle bag. Normally you keep it disabled by having the specially wired jack-plug 'key' inserted in the small socket on the side of the device. To arm it, simply pull out the plug and keep it with you while you wander off, leaving the alarm to look after your bike. As a personal alarm you will probably not want the anxiety of carrying it around without shaking it, so you just disarm it by inserting the plug. If ever you want to raise the alarm, hold the device upside down and pull out the plug.

Other ideas are to leave it lying on top of the TV set or hanging on the back of a valuable picture, or use it to booby-trap a cupboard. Depending on how you mount the mercury switch inside the case, the shrieking can begin at the slightest disturbance.



While it's shown a bit spread out here for clarity, the bike and personal alarm fits into the 35 x 160mm piece of tubing shown in the top of the picture.

How it works

The circuit is based on a 7555 timer IC (Fig.1). We use the CMOS version of the 555 IC, not the original bipolar version because the 7555 takes so much less current when inactive and makes it feasible to power the circuit from a 9V PP3 battery. The battery is permanently connected so there is no need to remember to switch the alarm on or off.

The IC is wired as a monostable, with its output normally low, but when the circuit is triggered the output goes high for a period depending on the values of R1 and C1. The ON period is defined by the formula $t = 1.1RC$ so, with the values used here, the ON time is 11 seconds. You can get a longer ON period by increasing either R1 or C1 or both, but it is not practicable to increase it by much because leakage through the capacitor may then prevent the circuit from ever turning OFF.

The circuit is controlled by two switches. SW1 is a mercury tilt-switch, connected between the 0V rail and the trigger input of the 7555. A pull-up resistor R2 normally holds the trigger input high, but any shaking of the tilt switch will cause it to make contact for an instant, shorting the input to 0V and triggering the IC.

The other control switch (SW2) is a standard mono audio socket. The mono plug which fits this socket has its terminals wired together, and so when the plug is inserted, the terminals of the socket are electrically connected through the plug. The reset pin of the IC is then grounded through the socket and so the chip can't produce a pulse when triggered; in this way the alarm is disabled.

When the plug is removed the terminals of

Fig.1

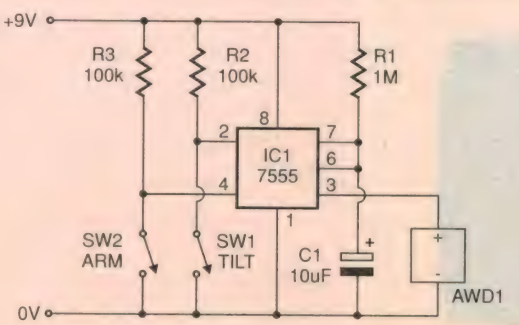


Fig.2

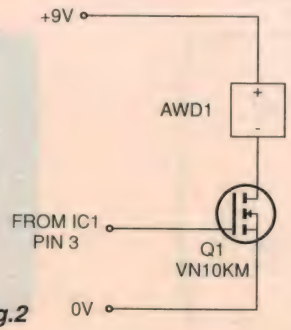


Fig.1 is the schematic for the full circuit which is based on the CMOS version of the 555. Fig.2 shows how to modify the circuit to use a MOSFET to drive a louder siren. At right is the component overlay for the alarm, and the diagram at far right shows how to wire in the extra MOSFET if needed.

the socket are open-circuit, and the pull-up resistor R3 holds the reset terminal close to the supply voltage; the IC can now be triggered by the mercury switch. This switching arrangement is simple and cheap, yet is an effective way of providing an arming switch that can not be disarmed by an unauthorised person. (Unless they just happen to have with them an audio plug of the right diameter, with its terminals wired together!)

This is a low-cost circuit, which limits the amount we can spend on the siren to just over $3. For that money there are a number of sirens available with outputs rated at about 85dB. This is certainly attention-getting, although not likely to wake the next-door neighbour. Two or three dollars more will purchase a louder siren (100dB), and some of these have a warbling or pulsating note which stands out well against background noise.

If you want an even louder noise, you will need to spend about $25 on the siren, for which you can obtain one with up to 120dB output and a warbling note. This type is really deafening! It will not be exactly portable, but will fit comfortably in the saddlebag of a bike.

The same circuit can be used for the more powerful sirens, and with certain types of siren it is possible to fit the circuit board inside the case of the siren. Note that the most powerful sirens require 200mA to drive them, but the 7555 can deliver only 100mA. To drive such a siren, you can add a MOSFET to the circuit as shown in Fig.2.

Construction

It is best to consider the style of the enclosure before building the circuit. The circuit can be fitted inside almost any kind of plastic box, preferably a free one (they're cheaper!), and it is possibly a good idea if the finished project looks quite unlike an alarm-raising device.

We decided that the cheapest enclosure could be made from a short offcut of 34mm PVC water pipe (Fig 3). This is a convenient shape for a hand-held personal alarm. The final product has the minimum of external features. The siren is visible at one end, there is a wooden plug to close the other end, and the audio socket is half-way along.

The siren we used is cylindrical (most are) and is a very loose fit in the tube. We decided to wrap a strip of plastic sponge around it before forcing it into one end of the tube. It could have been fixed more permanently in place using a filler material, but this would have made it difficult to remove if repairs were needed.

The circuit board was cut so that its depth was only a fraction less than the internal diameter of the tube. The board is thus automaticallt supported inside the tube. When laying out the larger components it is important to place them so that the board can slip easily into the tube. The battery fits comfortably into the tube, the leads of the battery clip being long enough to let the battery drop out of the tube for replacing. The end of the tube next to the battery is closed with a wooden plug, held in place by two screws.

First assemble the circuit on the board. Layout can be compact, as in Fig.4 to fit the circuit into the narrow tube or other small container. If you are using a more powerful siren, set out the left-hand end of the circuit board as in Fig.5. Check the way your tilt-switch operates before you solder it in and leave room for adjusting its angle. Ours was off (open-circuit) when tilted downward.

The tilt switch is soldered in by the tips of its leads, which are left long. Depending on the exact angle the switch is set at by bending its leads, you can adjust how sensitive the switch is to vibration.

Complete the assembly and test the circuit before inserting it in the tube. The lengths of leads to the siren, SW2 and the battery clip must allow the various parts of the circuit to lie in line inside the tube. Begin testing with the battery in its clip and the plug in the SW2 socket. The siren should not sound, no matter how much you shake the assembly.

Now turn the circuit board so that SW1 is top-down (in its off position) and remove the plug. There should still be no sound, but the siren should be triggered by any alteration in the angle of SW1, or any shaking of the circuit. It continues to sound until 10 seconds after it has finally been returned to its open-circuit position, or instantly if the plug is replaced in the socket. ❖

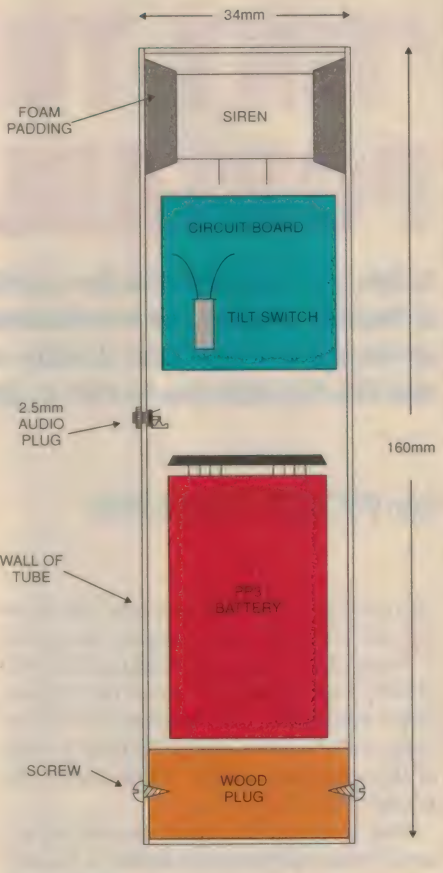


Fig.3: Here's how to assemble it all in the tube; Mount the siren on long leads, and fix it in place first. Then insert the board, socket and battery, and hold it all in place with some foam packing and the wooden plug.

PARTS LIST

Resistors
(1/4W metal film, 5% tolerance)

R1	1M
R2,3	100k

Capacitors

C1	10uF/16VW electrolytic, radial leads

Semiconductors

IC1	7555, CMOS timer IC
Q1	VN10KM or similar n-channel MOSFET (for high-power version only)

Miscellaneous

SW1	Mercury tilt-switch
SW2	2.5mm mono audio socket (panel mounting) and plug .
AWD1	Piezo-electric sounder (NOT a buzzer or magnetic transducer)

Matrix board (size depends on dimensions of enclosure), terminal pins (4 off), 8-pin IC socket, PP3 battery clip and battery.

Fig.4

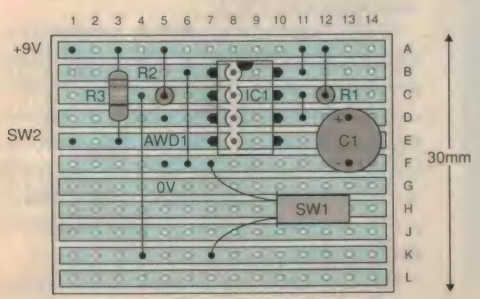
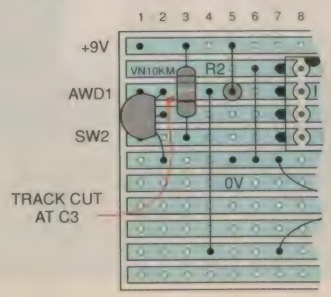


Fig.5



'TINY TUBE' PORTABLE LIGHTS - 2

In this part we describe the construction of two more 'tiny tube' applications: a flashing beacon and troubleshooting lamp that fits in those hard-to-get-at places, and an emergency light that doubles as a general purpose camping light. They're both battery powered, and like the light box in Part 1, give out an amazing amount of pure white light.

by PETER PHILLIPS

As in Part 1, the two 'tiny tube' lamps in this article are very compact, due to the size of the fluorescent backlighting tube (160 by 5mm dia) and the size of the NiCads. These rectangular cells measure 16 x 50 x 5mm and are rated at around 63mAh. A pack of 20 cells gives a 12V, 1.2Ah battery of around 100 x 35 x 35mm.

Both lamps in this article are driven by the inverter unit described in Part 1, which, along with the backlighting assembly and the NiCads, is available as a kit from Oatley Electronics. When driving the tube at around 80% brilliance, the current consumption of the inverter is around 300mA, giving at least four hours of operation from a fully charged battery — or even more if you further reduce the brilliance.

Emergency light

This unit is the simplest of the three lights. It has an inverter to drive the tube, a battery pack and a relay. When mains power is available to the unit, its internal battery pack is trickle charged. When the mains power is interrupted, the relay turns off and the battery pack drives the inverter, lighting the tube. That is, in a blackout, the unit lights automatically for the duration of the interruption, or until its battery is exhausted.

Of course, this is not the only use you can put it to. Being compact and portable, it can also be used as a general purpose light by adding an on-off switch in parallel with the relay contacts, so the light can be turned on or off as required.

The construction uses parts of the reflector-diffuser section of the original backlight section. As we explained in Part 1, these parts, like the tube, are especially designed for maximum light output, so it makes sense to use them where possible. Everything fits into a plastic jiffy box, with the tube mounted on the top of the box, giving a compact unit that can be placed anywhere you need back-up lighting in the event of a blackout.

The circuit has two parts: the inverter for the tube, and the relay-battery section. The inverter circuit is shown in Fig.1, and is available as a kit. Unlike the other lights, the inverter circuit is not modified. The rest of the circuit is in Fig.2.

In Fig.2, D1 and C3 form a halfwave rectifier to power the relay and trickle-charge the battery pack. We used an 18V centre-tapped transformer from Altronics, but any similar transformer will do. The Altronics transformer has an internal fuse, so if you use a different transformer, add a 250mA fuse between the mains and the primary of the transformer.

When mains power is applied, the relay is energised, holding the relay contacts open and isolating the inverter from the battery.

The emergency/camping light is at rear left in this pic, with the flashing beacon at right front. At left front are some of the compact NiCad cells.

The battery pack comprises 20 NiCad cells, connected as two 12V batteries in parallel. Each battery is charged via a 2.7k resistor (R3 and R4), giving a charge current to each battery of around 5mA. This current is enough to slowly charge the batteries (it could take a week to charge from a totally discharged state), and to also keep the batteries fully charged. Diodes D2 and D3 prevent one battery discharging into the other.

When the mains power is off, the relay is de-energised and its contacts close, connecting the inverter to the battery pack via D4 and R8, and D5 and R9. The resistors ensure equal load sharing, and the diodes isolate the two 12V batteries from each other.

In the prototype, we used a 12V DC relay with a coil current of 30mA. Resistor R7 limits the voltage across the relay coil, so if you use a different relay, you might need to change the value of R7. The LED indicates that mains power is applied, with resistors R5 and R6 limiting the LED current to around 15mA.

Construction

There are three tasks in building this light: making the inverter itself, making the circuit in Fig.2, and fitting it all in a case. The inverter part is probably the easiest, as everything mounts on the circuit board supplied in the kit. The layout for the inverter PCB was shown in Part 1.

We built the circuit of Fig.2 on strip board. We haven't designed a printed circuit board for it, as it's easy to make on strip board and you might want to add your own modifications. As well, you could be using a different transformer.

We mounted the transformer and all components in Fig.2 (except the batteries) onto a piece of 78mm x 40mm strip board. This allows the board to fit into slots on either the side of the box, giving it good support. We used a plastic jiffy box with outside dimensions of 95 x 158 x 50mm.

The LED is mounted on the top of the strip board so it pokes through a hole in the lid. Notice in the circuit that there are two 1W resistors (R5 and R6) to limit the LED current. A 1.8k 1W resistor will do, but as the power dissipation is around 0.8W, two 1W resistors in series give a better power rating margin.

The battery pack is made from 20 individual cells. While there are many possible stacking arrangements, the one we used is shown in Fig.3. The cells are supplied in 7.2V battery packs, each of which has a thermal cutout that can be incorporated in both 12V batteries. The cutouts are not essential, but it makes sense to use them if possible.

The complete arrangement comprises a stack of five layers, with each layer two cells long by two cells wide. The stacking arrangement in Fig.3 shows one 12V battery.

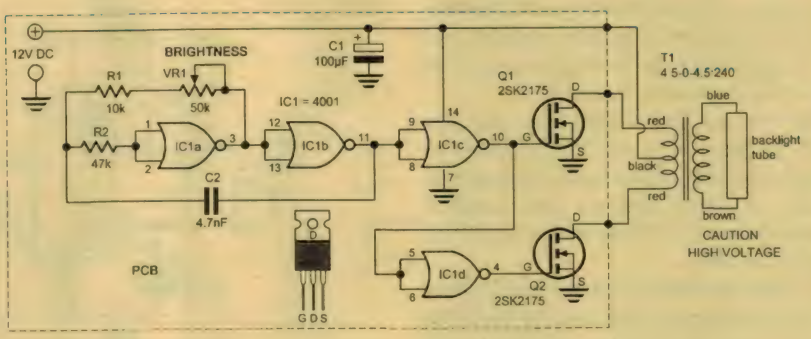


Fig.1: The inverter circuit as supplied in the kit. This circuit is unmodified for the emergency light, and slightly modified in the beacon. For more details, see Part 1 of this article.

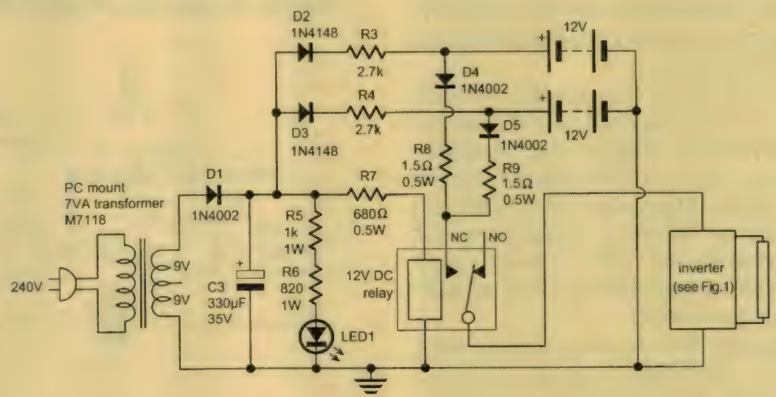
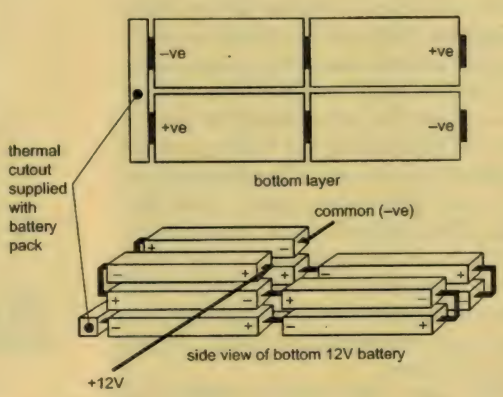


Fig.2: This is the rest of the circuit of the emergency light. When mains power is applied, the relay is held on, the LED lights and the battery pack charges via D2-R3, and D3-R4. When there's no mains power, the relay de-energises and connects the inverter to the battery via D4-R8 and D5-R9.

Fig.3: The stacking arrangement of the battery pack for both lights in this article. The first battery is connected as shown. The second battery is connected in the same way, then placed upside down on top of the first. The thermal cutouts supplied with the cells are used as shown, one per 12V battery.



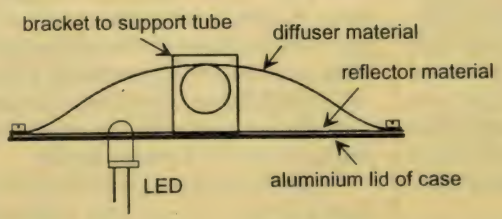


Fig.4: To get the best light output, use pieces of the diffuser and the reflector materials (cut to suit), placed as shown here. The tube is supported at either end with suitable brackets and the leads taken to the inside of the case.

The second battery is identical, and is placed upside down on the first, putting the output terminals in the middle of the pack. The negative terminals are diagonally opposite, and are connected together inside the pack, with one lead (the common) taken out.

The two positive connections are also taken out from the pack. It's important to insulate each cell, and to ensure all lead connections inside the pack are well insulated, as a short circuit inside the pack will quickly destroy the cells.

We fitted the fluorescent tube inside 8mm OD glass tubing and attached the tubing to the aluminium lid of the box with two brackets like those used to hold a curtain rod. We also ran a fine wire inside the glass tubing to connect to one end of the tube. This allows both tube connections to enter the case at the same point. If you can't get glass tubing, use clear plastic tubing.

As shown in Fig.4, to get the best light output, we used pieces of the reflector and diffuser materials from the original display backplane, cut to size. The reflector material lies under the supporting brackets for the tube, and the diffuser is formed over the tube. When lit, the LED is clearly visible through the diffuser (because when the LED is lit, the fluoro isn't).

Obviously there are many ways to build this light, depending on the materials you have at hand, what modifications you might make and so on. But at least our construction method will give you some ideas. Now to our second light.

Strobe/beacon

It's difficult to put a name to this light, as it has so many uses. It started life as a troubleshooting lamp, the aim being to make a light that could be inserted into pipes, holes, small cavities: where no other light could go.

To achieve this, we enclosed the lamp in 8mm OD glass tubing and fitted one end of the tubing into the case of a felt-tipped pen, cut to suit. This gave a sturdy 'light tube' about 150mm long that could illuminate difficult areas in an appliance, circuit board, motor — you name it. Unlike a torch, which gives a beam in one direction, the tube gives light in all directions; pure white for best colour rendition.

While such a light is very useful, even more uses could be obtained by adding circuitry to strobe the light at a variable rate, and by making the brightness of the tube adjustable from the front panel. Adding the variable strobing effect allows the light to be used as a flashing beacon, as a simple disco strobe, or even for measuring the RPM of a rotating shaft. This latter use would involve calibrating the strobe rate control...

Making the brightness of the tube variable allows the power consumption to be controlled, giving a beacon that can flash for 10 hours or more from its battery pack, depending on the brightness setting and the flash rate. Even at minimum brightness, the tube gives out a surprising amount of light. Because it's pure white, it can be seen for a long distance, making it ideal as a guiding beacon.

To accommodate all these uses, we connected the tube to the inverter with a 450mm long lead, and also drilled a hole in the case to hold the tube assembly. This allows the tube to be either handheld or supported vertically by the case. Now to the circuit details.

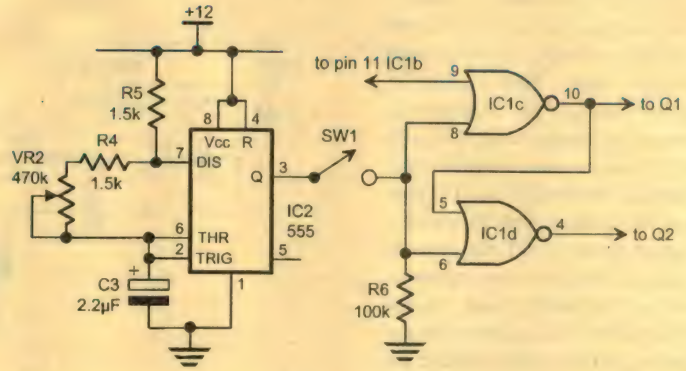


Fig.5: When SW1 is closed, the 555 timer controls IC1c and d, enabling them when low and disabling them when high, thus strobing the inverter's output voltage. Note the changes that are needed on the inverter board.

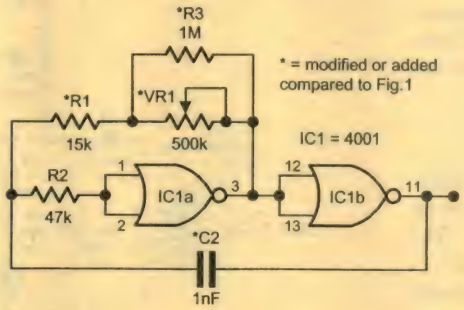


Fig.6. These modifications to the inverter board give a wider range of brightness settings for the tube. For more details see Part 1.

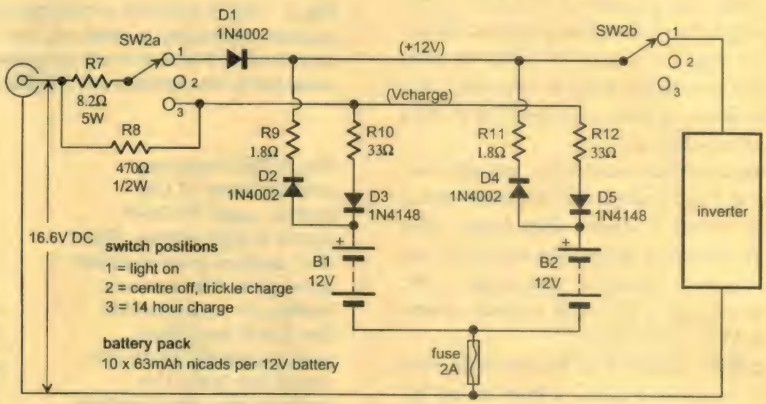
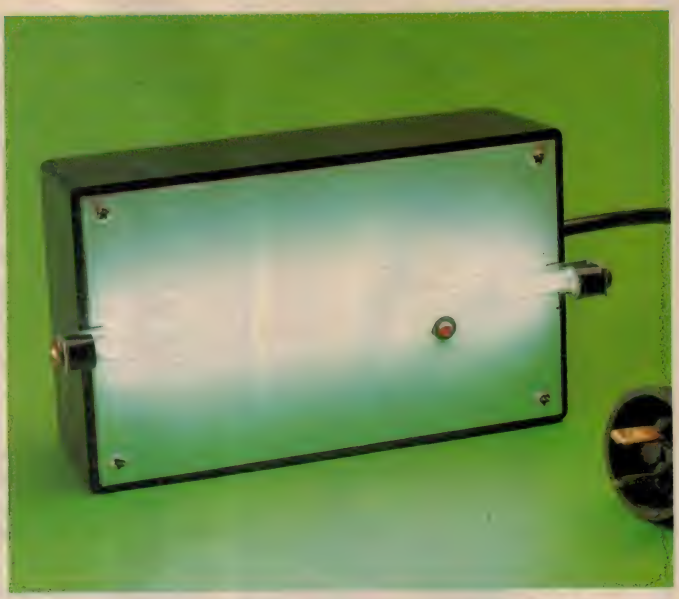


Fig.7: The battery charge-discharge circuit for the beacon is shown here. Except for one less battery and component values, its operation is identical to that described in Part 1.

Beacon circuitry

There are again three sections to the circuit: the inverter, a variable oscillator to strobe the tube, and the charge/discharge circuitry for the battery pack. The inverter needs minor modifications to interface to the oscillator, and to give a front panel control for the tube brightness. These changes are shown in Figs.5 and 6.

The lamp can be detached from the flashing beacon electronics, and used as a strobe in confined places.



The emergency/camping lamp shown operating with the diffusing cover removed. The charging LED is also visible.

The oscillator and its connections to the inverter are in Fig.5. A 555 timer is connected as an astable with a variable frequency range of around 0.7Hz to nearly 140Hz. When SW1 is open, R6 pulls pins 8 and 6 of IC1 low, making gates IC1c and d behave as inverters, as in the original circuit. If SW1 is closed, the output of the 555 controls the behaviour of these two gates.

When the 555 output is high, the output of both gates is low, preventing the MOSFETs in the inverter from operating. When the 555 output is low, the gates act as inverters, and the MOSFETs are driven in the usual way. Because the value of VR2 is much higher than R5, the 555 duty cycle is around 50%, giving equal on and off times.

The changes to the inverter to allow the tube brightness to be controlled over a wider range are shown in Fig.6. These modifications were described in Part 1. On the prototype, our component values gave a maximum inverter frequency of 24kHz (minimum brightness) and a minimum frequency of 1.5kHz.

The battery charge/discharge circuit is shown in Fig.7, and is similar to that used in the light box in Part 1. The main difference is the use of two batteries in this light, compared to three in the light box. We won't repeat the circuit description, as apart from different component numbers and one less 12V battery, its operation is identical to that given in Part 1.

Construction

As you can see from the photos, we built this unit into a very small metal box. However, in hindsight it was only just large enough, and took a lot of fiddling to make everything fit. The box size is 125 x 38 x 68, so we recommend this as the smallest practical size.

We built the inverter and the 555 circuitry on a single piece of strip board. However, you'll probably use the supplied PCB for the inverter and build the 555 circuit on a separate piece of strip board, or whatever. The 555 circuit is very simple, with only four on-board components, as the potentiometer and SW1 are mounted on the

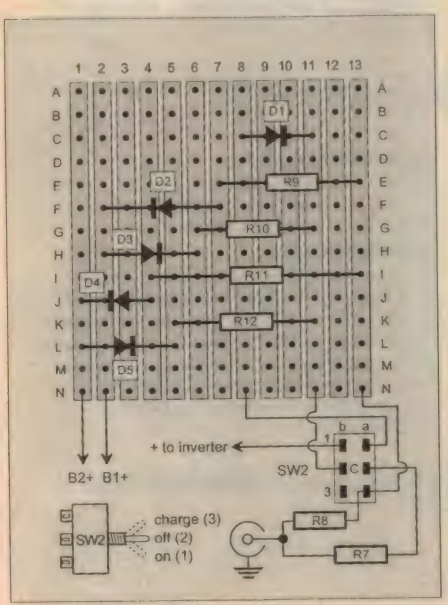


Fig.8 (left): This strip board layout is for the battery charge-discharge circuit shown in Fig.7. It has the same dimensions as the end of the battery pack, to which it can be attached. At right is the inside of the flashing beacon electronics.

front panel of the case. Because of its simplicity, we haven't produced a PCB design for the 555 timer circuit.

You'll need to cut the tracks on the inverter board between pins 5 and 6, and also between pins 8 and 9 of IC1, and join pins 8 and 6 with a wire link on the track side of the board. Then add resistor R6 between this link and ground, and take a wire from the link to SW1.

The battery pack construction is the same as for the emergency light, shown in Fig.3. We built the charge-discharge circuitry on a piece of strip board, and attached this board to one end of the battery pack. The layout we used for the board is shown in Fig.8, and has the same width and height as the battery pack. It can be attached to the pack with double-sided adhesive tape. We soldered the 2A fuse directly into the common lead from the battery pack, rather than use a fuse holder. It's unlikely to blow in normal use, but is essential for fault protection.

Resistors R7 and R8 are mounted between SW2 and the DC input socket. Note that R7 is a 5W resistor. We used a centre-off DPDT switch for SW2, but you could also use a three position, double pole wafer switch. The type of DC input socket is also up to you. The choice of case is also not important; just make sure it's large enough. It can be either metal or plastic. If you use a metal case, make sure there's good insulation between it and the electronics.

The fluorescent tube should have a protective housing, such as glass or plastic tubing. Run a fine wire from the exposed end of the tube, and connect this wire to the lead connecting the tube to the inverter. We used a piece of twin coax from a set of headphones (available from a $2 shop) as the connecting lead for the tube.

In conclusion

As you can now see, these lamps are ideal for hobbyist projects. They require no special parts, and in many cases you'll have the necessary bits and pieces in your workshop. With a few hours of work you can build something that is not available commercially, and have something that will prove extremely useful. You'll also find they will attract a lot of attention. And best of all, you can build them for a surprisingly low cost. ❖

PARTS LIST

Emergency light (Fig.2)

Resistors

R3,4	2.7k 1/4W
R5	1k 1/2W
R6	820Ω 1W
R7	680Ω 1/2W
R8,9	1.5Ω 1/2W

Semiconductors

D1,4,5	1N4002 1A diode
D2,3	1N4148 100mA diode
LED1	Red 5mm LED

Capacitors

C3	330uF 35VW electrolytic

Miscellaneous

SPDT 12V relay; 240:18V transformer M7118 or equiv; 20 x 63mAh NiCad cells; inverter PCB and components (see Part 1); backlighting assembly; mains lead and plug; suitable case and hardware as described in text.

Strobe/Beacon (Figs 5,6 and 7)

Resistors

(1/4W unless specified)

R4,5	1.5k
R6	100k
R7	8.2Ω 5W
R8	470Ω 1/2W
R9,11	1.8Ω 1/2W
R10,12	33Ω 1/2W
VR2	470k panel mount pot with switch

Capacitors

C3	2.2uF tantalum

Semiconductors

IC2	555 timer IC
D1,2,4	1N4002 1A diode
D3,5	1N4148 100mA diode

Miscellaneous

Centre-off DPDT minature toggle switch or equivalent wafer switch; 2.1mm DC power socket; 13.8V 1A DC plugpack; 20 x 63mAh NiCad cells; 2A M205 fuse; inverter PCB and parts, plus those for brightness control (see Part 1); strip board to suit; knobs; suitable case, backlight assembly; hardware as described in text.

Parts for this project are available from Oatley Electronics, phone (02) 9584 3563. Postal address (mail orders): PO Box 89, Oatley NSW 2223.
Inverter kit, with backlight assembly, $17
Data sheet for LCD, $2
Suitable 13.8V 1A plugpack, $10
NiCad cells, 30 for $10
Packing and postage charges $6
Note that the design of this project (inc. the PCB design) is copyright to Oatley Electronics.

300W Subwoofer Amp kit from Jaycar

Every now and then we have a chance to check out how our various projects appear in kit form, when put together by resellers such as Jaycar Electronics. They recently sent us a built-up version of their kit for the *EA* Playmaster 300W Subwoofer amp, and not surprisingly we were pretty keen to take a look...

by ROB EVANS

Judging by the degree of interest from readers and retailers alike, our 300W Subwoofer Amp has been quite a popular kit since its inception in the April 1995 issue of *Electronics Australia*. We took considerable effort to make sure that the amp is easy to build and offers a reliable but high performance, so it's quite gratifying to know that a large number of the amp kits are now in use.

However we're *also* very aware of the effort that goes into preparing this type of kit by resellers such as Jaycar, who have to arrange custom chassis metalwork, panel artwork, circuit board manufacture, component sourcing, kit packaging/instructions, and a host of other vendor's jobs — including quality-control checking. So regardless of how successful we may have been in creating a project design here at *EA*, the merit of the kit version will often depend upon how well the supplier has followed through.

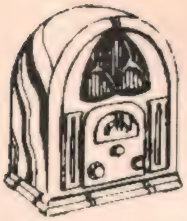
We're happy to report that in the case of our 300W Subwoofer Amp shown here, Jaycar has completed this part of the process very well indeed. The result is an attractively finished amp that matches the performance of our prototype on the test bench, and at the asking price of $349 seems to represent very good value for money.

We first took a close look at the amp's chassis and found it to be both solid and well constructed, with the powder-coat finish offering a pleasing but functional look. The silk-screened front panel is also well done, and like the main chassis components is prepunched to make assembly easier — a luxury we certainly don't have when assembling our prototypes...

Removing the lid from the amp showed that the Jaycar kit department had done a creditable job when assembling the kit, and also revealed a number of 'up market' components that are supplied with the Jaycar version. These are 1% metal film resistors, gold insert machined IC sockets, 'low-capacitance' input/output signal cable, gold-plated RCA sockets, and heavy-duty automotive-style hookup wire for the supply rail and speaker connections.

Jaycar also supplies a series of 'construction supplement' sheets with the kit, which provide a large number of helpful hints and diagrams to aid assembly. These are quite detailed, clearly expressed and include large-scale reproductions of our original overlay diagrams, so we'd anticipate that putting the Jaycar kit together should be a smooth process.

All in all then, we were very impressed with the quality of the Jaycar 300W Subwoofer Amp kit, and would have no hesitation in recommending it to constructors. If you'd like to know more about the kit or the amp in general, see the April 1995 issue of *Electronics Australia* or call in at your nearest Jaycar store, where you can get the complete Subwoofer Amp kit for just $349. ❖



Vintage Radio

Early test equipment - *continued*

As part of a continuing look at vintage test equipment, this month we examine some early modulated oscillators and cathode-ray oscilloscopes.

The need for a source of RF energy for the purposes of adjusting a radio receiver was established in the late 1920s. With the advent of the 'single dial' tuning control, the listener-in no longer had the option/chore of individually adjusting each tuning capacitor for optimum results — but conversely the internal tuned circuits had to be adjusted to 'track' each other properly. This was especially the case with superhets, where need to adjust oscillator tracking is quite crucial. A neutrodyne also had to be carefully adjusted if it was to work properly.

The usual method was in each case to tune to a convenient radio station and then make the adjustments. However it was soon realised that merely to select a suitable radio station was unreliable, particularly if the highest frequency available was only say 1000kHz.

Another important consideration is that convenient signals could often be too strong. So there arose a definite need for a convenient local source of RF signals, at various frequencies.

Early test oscillators

Fig.1 shows the circuit for an early US attempt at an RF test oscillator. The circuit is a basic Hartley oscillator, self-modulated by the high value of grid leak resistor (3M) in conjunction with the 250pF grid capacitor. The value of grid leak in particular will determine the pitch of the modulation tone.

Note the novel means of, quite literally, 'lighting' the 201A valve! The 25 watt bulb in series with the 110-volt supply will pass just under 0.25 amp, a near-enough figure for the purpose.

One could be forgiven for assuming that the fluctuating AC on the valve's filament would superimpose its own form of 50Hz (or for the USA 60Hz) modulation upon the already modulated signal. After all, the 201A was a directly-heated valve. However, if the truth be known, the very early electric sets had very poor filtering indeed and were prone to hum themselves — so what is the problem with the RF oscillator adding a bit more?

Another point is that the early speakers were so poor in bass response that they simply didn't work at 50Hz, anyway!

Despite its crudity the early circuit of Fig.1 did have a couple of refinements. It was fully enclosed in a metal box, although the coil should have been shown outside the dotted line, because the coupling between oscillator and set was via stray coupling from the large diameter coil. The other refinement was the use of RF filter chokes in series with the AC mains cord, in order to keep the RF in; otherwise the chord itself acts as a transmitting antenna.

There is no attempt at an attenuation control, and one assumes that the tuning would have been calibrated by hand, using either known signal frequencies or by comparison with a more sophisticated instrument.

TABLE 1: AWA C1070 Oscillator Ranges & Output

Range	X Factor	Frequency	Max RF out
A	1.4	96 - 250kHz	400mV
B	1.0	240 - 600kHz	300mV
C	1.0	0.56 - 1.42MHz	300mV
D	0.5	1.36 - 3.33MHz	150mV
E	0.2	3.12 - 8.10MHz	60mV
F	0.08	7.90 - 20.0MHz	25mV

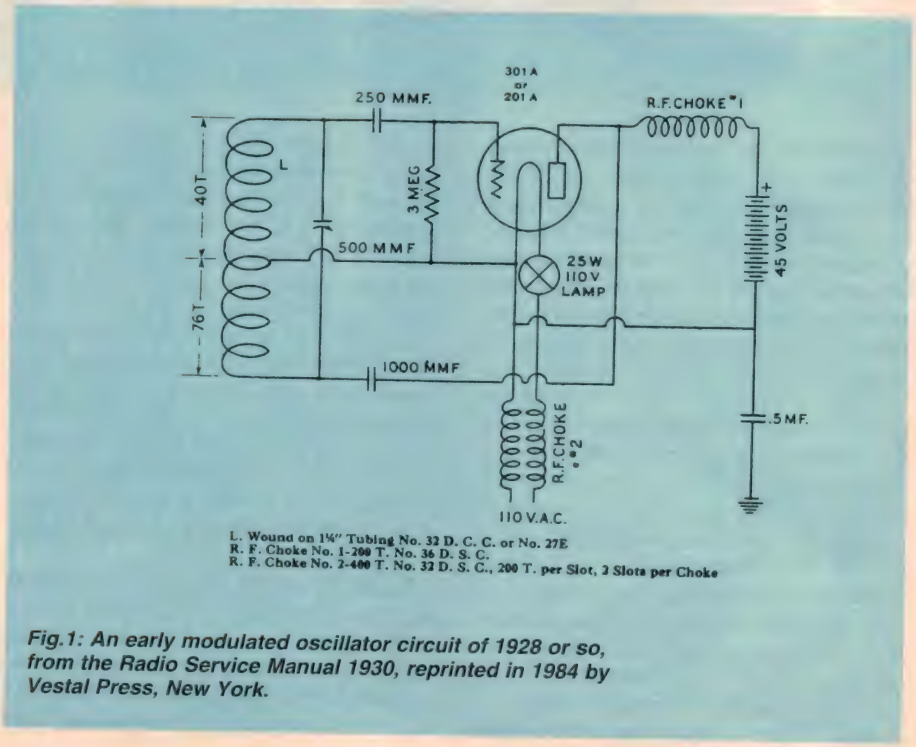


Fig.1: An early modulated oscillator circuit of 1928 or so, from the Radio Service Manual 1930, reprinted in 1984 by Vestal Press, New York.

by Roger Johnson

The AWA C1070

One of the earlier Australian factory-built modulated oscillators is the AWA C1070, which appeared in the literature for 1936. It was described by the manufacturers as '...able to carry out the following tests rapidly and with ample reserve of accuracy'.

Specifically designed for servicemen and 'the trade' rather than the home constructor or experimenter, this instrument was not cheap; it sold for 14 guineas. But amongst its glowing list of claims are:

(1) Determining the stage gain in RF or IF amplifiers;

(2) Testing of valves for performance under working conditions; and

(3) Determination of image ratio, spaced amongst the more mundane jobs such as dial calibration and peaking tuned circuits in superhets and TRF's.

There is some basis of claim for the list of capabilities. Firstly, there is a fully calibrated rotovision dial — which incidentally is the same escutcheon etc. used on the 1935 range of receivers. The calibration accuracy is claimed to be better than 1% on the lower ranges, and within 2% on the others. The frequency coverage is from 100kHz to 20MHz in six switched ranges.

Most importantly, though, is the use of an attenuator, with the output range calibrated from 1 microvolt to 300 millivolts. For the various ranges, a multiplying factor is applied to the attenuator setting per Table 1.

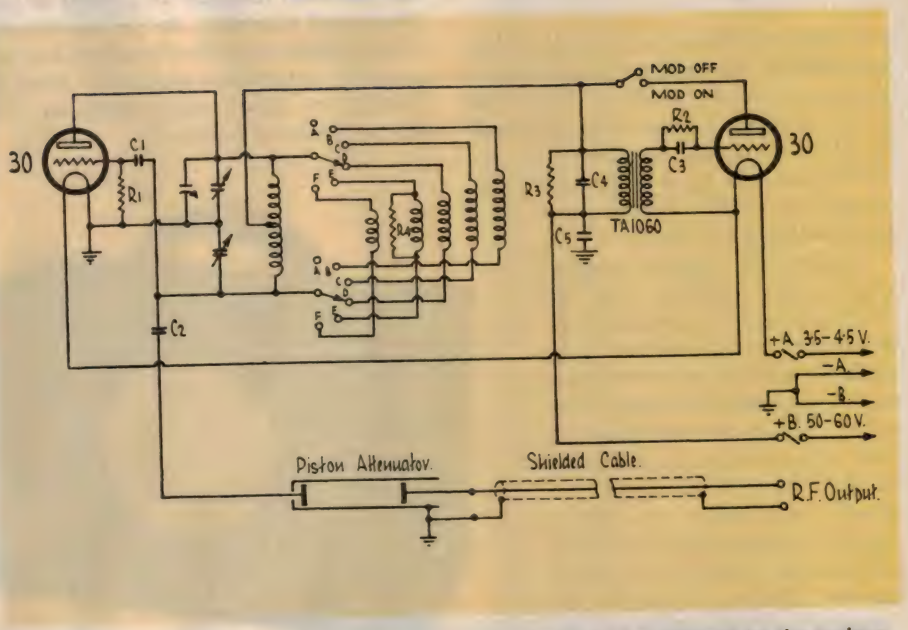


Fig.2: The circuit for the AWA C1070 modulated oscillator, as published by the makers in 1936.

Construction

Like the unsophisticated unit of Fig.1, the C1070 is fully enclosed in a metal case and the manufacturer claimed that leakage cannot be detected except at about 20MHz, where it is less than one microvolt. (Such figures could not be claimed for budget priced instruments for the next 50 or so years, especially ones intended for AC mains operation — regardless of whether they are solid state devices or not!)

To achieve this, battery type valves were chosen, and the dry batteries are fully contained within the case. There is a little panel at the side containing test sockets for convenient checking of the battery voltages.

It is stressed that the special shielded cable must be used, otherwise the attenuation calibration will be disturbed.

The C1070 circuit

The circuit of the C1070 is again based on a Hartley oscillator (Fig.2), with switched coils covering the frequency ranges. The modulation section looks to be a tuned plate oscillator in which the frequency is, according to the text, determined by the air gap of the special modulation transformer.

Presumably grid components R2 and C3 are chosen to prevent squegging, and C4 has been chosen for an optimum LC ratio. The piston attenuator is an elaborate form of a small value variable capacitor. Curiously, no component values were given in the circuit diagram, which is taken from the original manual.

Fig.3 shows how the C1070 looked in a contemporary advertisement, while Fig.4 is a photo taken inside an example that is currently being restored. The modulation transformer and piston attenuator are clearly visible.

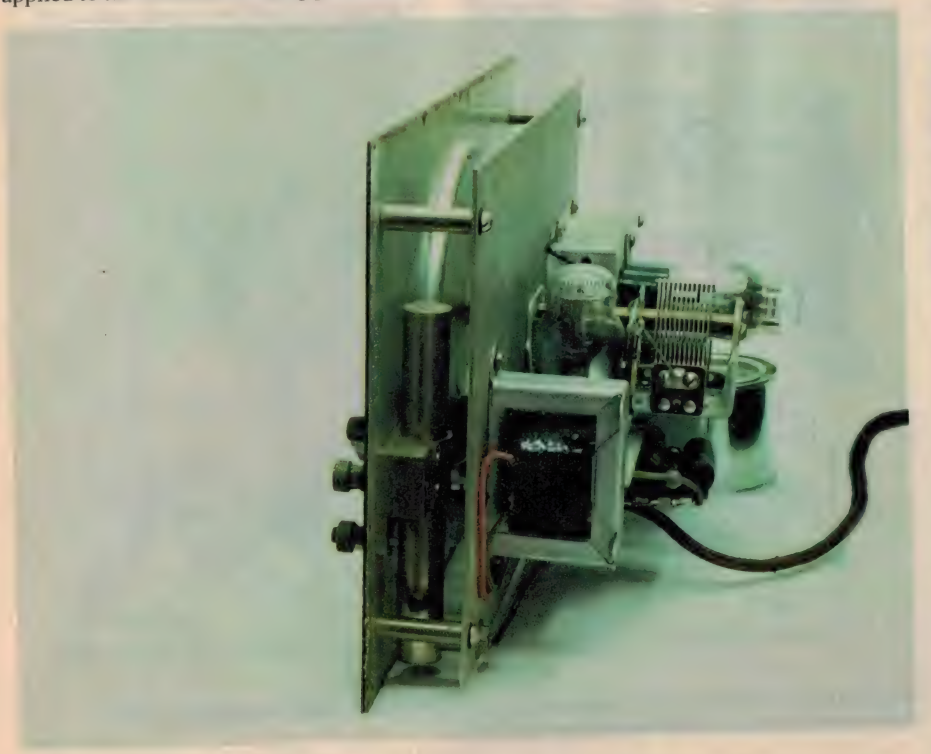


Fig.4: The 'works' of a C1070 removed from its cabinet, for restoration. The piston attenuator is the vertical tube in the left foreground.

Early CROs

No doubt the fluorescent properties of certain materials undergoing a bombardment of electrons is almost as old as vacuum tube technology itself, but harnessing this property into a useful and practical test instrument — the cathode-ray oscilloscope or 'CRO' did not occur much before about 1934 or 35.

Possibly the biggest problem confronting engineers was the development of a reliable and practical circuit which would cause the electron beam to travel from one side of the horizontal plates to the other, and then instantaneously back again in order to commence another trace. Such activity is referred to a 'sweep', for obvious reasons, and the sweep circuit in an oscilloscope is crucial to its practicability. (Because it provides the 'timebase', or time axis for the displayed waveform.)

One of the very early attempts was to use a continuously rotating potentiometer, driven by a small electric motor at constant speed, connected across a high voltage supply. The rotor was connected to one of the deflecting plates, and during its rotation the voltage was closer to one end of the potential or the other, depending upon its instantaneous position. By this dubious means, the horizontal trace was achieved.

The Thyratron

For an oscilloscope to be useful, it needs a reliable and linear sweep circuit, calibrated amplifiers, and a reliable high voltage source. The first of these requirements was achieved in early CROs by the use of the *thyratron*, or gas filled triode.

If we look at the circuit for a home construction CRO of 1942 shown in Fig.5, the thyratron is V3, a type 884. This tube and its octal equivalent were standard fare for CRO's for years to come.

The thyratron valve contains a small amount of ionising gas. At a certain critical voltage between anode and cathode, which can be determined by the grid (or cathode) bias, the gas will ionise and conduct current. Hence, the B+ supply, via resistors R14 and R15, charges up one of the capacitors selected by S3. When this capacitor is fully charged, that voltage appears at the plate of V3.

When the gas inside ionises, it conducts from anode to cathode. The associated capacitor is then discharged, and its voltage drops sharply. Once the anode potential has been removed as a result of the discharged capacitor, the gas de-ionises. The conductivity path is removed, and the capacitor commences recharging. Once it reaches its fully charged potential, the whole process is repeated.

Fig.3: How the AWA C1070 oscillator looked, from a contemporary advertisement.

The 'output', for want of a better term, from V3's anode appears at the horizontal deflection plate of the type 902 CRT after amplification by V4. The opposite plate is earthed.

This fluctuating voltage must as nearly as possible be sawtoothed in shape, and definitely not sinusoidal or any other form of variable shape. The electron beam must travel at a constant speed across the screen, and this can only be achieved if the changes in electrostatic potentials upon the deflection plates are quite linear. Otherwise, distortions occur in the resultant waveforms displayed on the tube.

The frequency at which this occurs depends upon the time constant of R14/15 and the associated C selected by S3. The switching is used in order to select various sweep ranges. In order to generate a linear waveform, which this circuit only approaches, 'R' must be high and 'C' must be low. A high RC time constant means a low speed across the tube.

The limitations of this timebase circuit mean that waveforms above about 20kHz simply cannot be displayed with any form of accuracy, so the timebase circuit was limited to just that.

HV power supply

The CROs of this era required a high negative potential supply for the tube cathode and focus grid, in addition to the more conventional B+. This was achieved using an additional winding continuing on from the normal high voltage winding, and using a separate rectifier valve which is connected in reverse mode. The extra high voltage winding is connected to the cathode, and the load appears between anode and earth. A

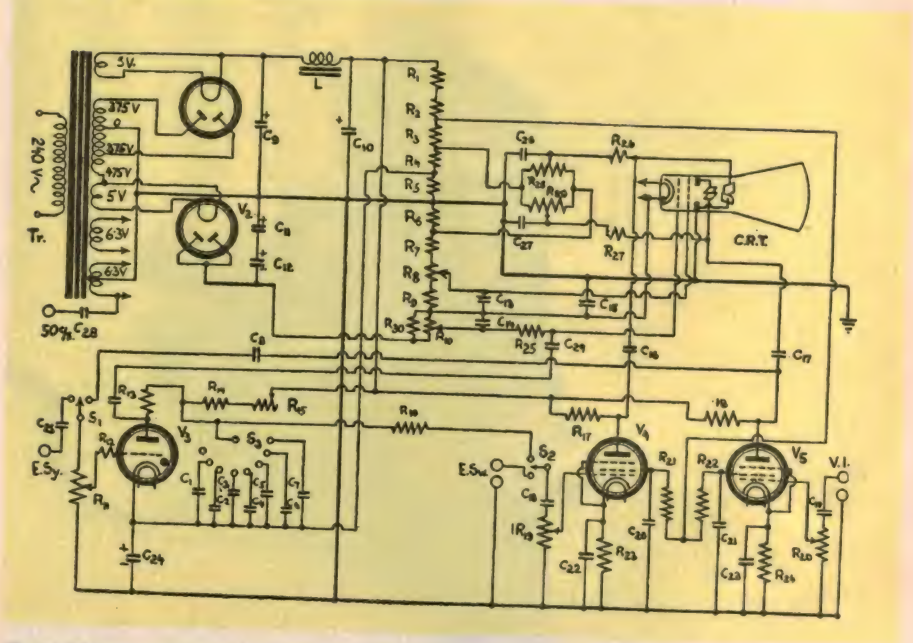


Fig.5: This circuit for home construction of a cathode-ray oscilloscope or 'CRO' appeared in Radio and Hobbies for April 1942.

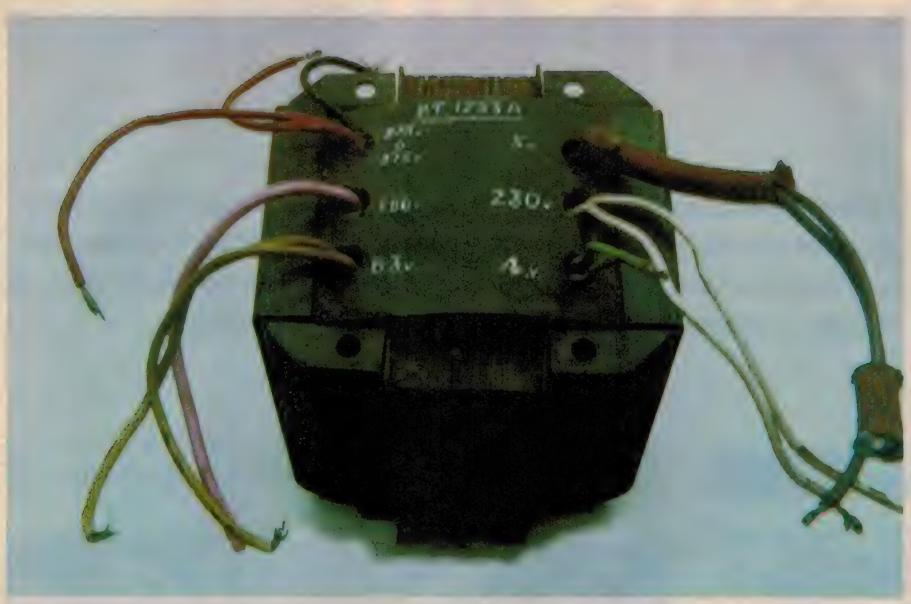


Fig.6: A power transformer designed for an early valve CRO. The additional high voltage winding lead can be seen at centre left.

high negative output voltage is available at the anode.

Notice that separate heater windings are required on the transformer, for the two rectifiers. An example of a transformer with this additional winding is shown in Fig.5.

(For those who are confused about how this works, take heart, because in a future column there will be a complete treatment of diodes, their applications and how they all operate. At this stage, though, please be assured that this circuit does work!)

Back to our CRO. A large negative potential is available at R10 and R30, and progressively down the resistance chain. This negative potential is connected to the cathode of the CRT (cathode-ray tube), in order to charge the electron stream sufficiently negative, so that it may be acted upon by the various focusing and deflection electrodes. The CRT needs its own separate filament supply — yet another winding on the transformer.

Limitations

All oscilloscopes, from these humble types to the latest digital storage varieties, have the same requirement: the timebase must be synchronised with the incoming signal. Otherwise, the trace produced would be a haphazard jumble. Internal 'Sync' on our subject instrument was achieved by the pot R11, connected via S1 and C8 from the anode of the vertical amplifier to the grid of V3. This fed some of the signal to be viewed to the thyratron grid — which worked, although not as reliably as one would like.

As you can see from Fig.4, a single stage of uncalibrated amplification (V4, V5) is used for each of the horizontal and vertical inputs to the CRT. The tube in itself has a frequency response limitation, and the gain of the amplifiers falls drastically above about 100kHz. The output of each stage is connected via C16 and C17 respectively, to their various deflection plates.

Whilst nowadays we may look at one of these early CROs in stunned amazement, 60 years ago they were drooled upon. As has been previously stated, the frequency range was limited to 20kHz, or in the audio range only. The amplifiers were not calibrated, and neither was the sweep. Not only that, there was no facility for DC signal input!

Despite all this, technicians of the day would use them to compare one waveform with another, rather than as a measuring instrument for obtaining precise results. Much more use of the horizontal input was made, whereby circular and elliptical traces were obtained, and duly interpreted. This is a forgotten art, and perhaps worthy of further explanation in the future.

Perhaps the biggest limitation was one of size. The most common CRTs were the 1" type 913, the 2" type 902 and the 3" type 903. Those three types represented about the limit of tubes for the home constructor, mainly because of cost — not just for the tube itself, but also the associated circuitry and hardware required. The transformers required to operate a larger tube were prohibitive.

The foregoing was not intended to give a detailed account of the two test instruments we've discussed, but rather to illustrate the technology of the day and give you an insight to their performance. ❖

Computer Clinic

Revving up your CPU, CGA queries and of course Win95 problems

I have another assortment of problems, questions and answers for you this month, including the incredible self-modifying CONFIG.SYS and how to break the speed limit without leaving your desk. First up, though, a question that depends on your point of view...

DOS for ever?

Does Windows NT require DOS to run? Will DOS ever go out of fashion if NT does not require DOS? (J.C. Tang, by email)

No, NT doesn't require DOS to run. In fact, NT comes with its own command line interface that *looks* like DOS, but typing **VER** comes up with 'Windows NT Version 4.0', so DOS it ain't.

Will DOS go out of fashion? Well, according to Microsoft, it already has. Microsoft no longer sells or provides support for DOS 6.22, so if your system hardware is under the minimum spec for Windows 95, you're stuck. Of course, Windows 95 comes with something called DOS 7, so the command line interface isn't quite dead yet.

As for third party software that runs under DOS, there's a little more hope. Windows 95 and Windows NT will both run DOS software, although NT is a bit more restrictive. Not all DOS software will run under NT, with games and hardware-intensive software being the worst affected. For this reason, even Microsoft realise that NT isn't the best system for everyone, and so Windows 95/98 with DOS 7 will probably be around for quite some time to come.

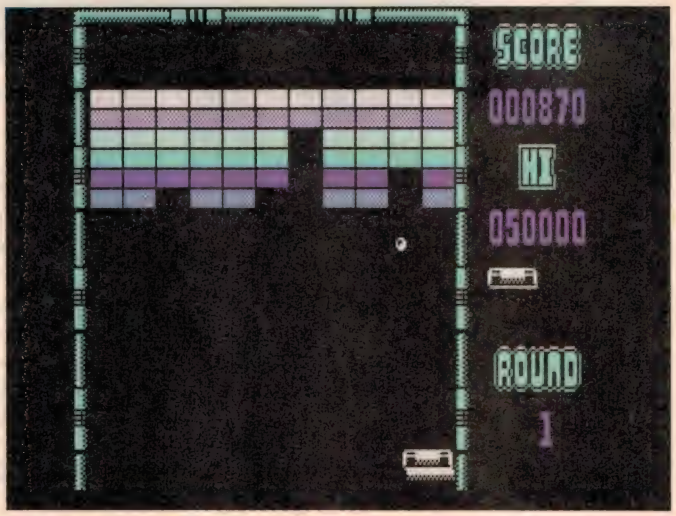
CGA on a TV

I recently acquired a 'black box' that that contained an RF modulator and an MC1367, along with other components on a PCB marked 'EA 89rgb8'. Having discovered that the MC1367 is a colour television RGB to PAL/NTSC encoder, I'm guessing that this device will allow me to use a TV with my computer, like I did with my Commodore 64. How should I go about doing this? (A.G. Clark, Mt Evelyn. Vic.)

Bad news, I'm afraid. Your box is an RGBI to PAL encoder (published in the August 1989 issue of *Electronics Australia*), and was indeed designed to convert RGB video from a CGA video card into PAL. Trouble is, although some televisions could handle the 15.75kHz refresh rate produced by CGA cards, modern VGA and SVGA video cards use a refresh rate of at least double this (31.5kHz), which is far too high for a television to lock onto. Even if you could get it working, you would have to use CGA mode — not a pleasant sight. (CGA is, or should I say was, easily out-performed by a Commodore 64.)

Another point is that televisions are definitely not designed for use as computer monitors; if you ever tried to make out fine detail on one of the home computers of the '80s, you'd know what I mean. The pixels on television screens are built to provide nice soft edges on everything, which is not a nice effect when you're trying to read text smaller than 48 point bold...

To sum up: if you have a CGA card, and you're willing to put up with 40 column text and four-colour graphics, and you don't want to use Windows or the majority of DOS apps, the DB9 cable should plug straight in. Otherwise, I'm afraid you're stuck with using your normal high resolution SVGA monitor.



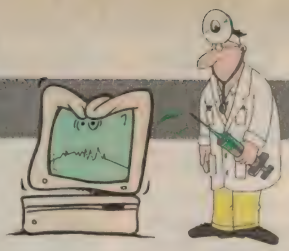
Above: The wonders of CGA: 320 x 200, with a whopping four colours! At upper right, A CONFIG.SYS 'fixed' by Win95 on exiting. Stomp on CTPNPSCN.DRV to prevent it from moving your CD-ROM to a new address up the road...

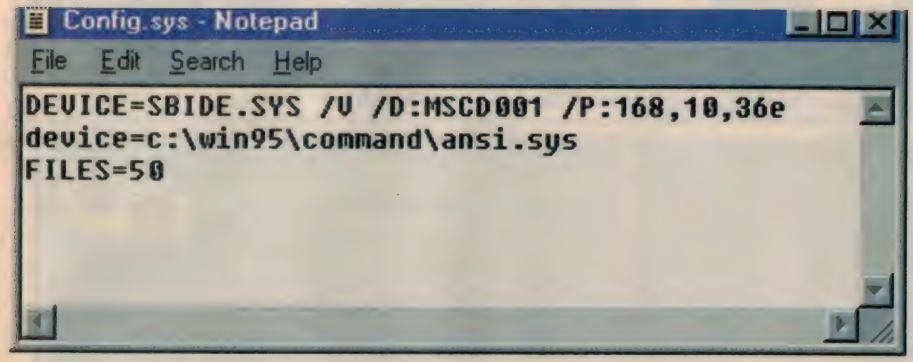
Win95 breaks it!

I have implemented your method for enabling CD-ROM drives in DOS, but have struck a problem. Windows 95 keeps modifying CONFIG.SYS, changing the /p setting for SBIDE.SYS to the wrong address. The only way I have found to stop this is to write protect CONFIG.SYS. Is there an easier way to prevent this from happening? (B. Blackman, by email)

I had this problem myself! Thought I was going mad. It's nice to know it's not just me. Anyway, reassured of my sanity, I did a little digging, and found that the problems you are having are caused by **CTPNPSCN.DRV**, an annoying little module that sits in your **C:\WINDOWS\SYSTEM** directory. Every time you boot, it searches through your startup files and mangles any entries for Creative Labs drivers that it finds. This is odd, as the file is installed by Creative's own installation software. I have no idea why it does this; maybe tech support gets a kickback... Seriously, though, if you don't want to keep **CONFIG.SYS** write protected, here's what to do:

1. Rename **CTPNPSCN.DRV** to **(CTPNPSCN.DRV)**





2. Edit **C:\WINDOWS\SYSTEM.INI** and remove any references to **CTPNPSCN.DRV** (but make a backup first!).
3. De-protect **CONFIG.SYS**.
4. Reboot.

With any luck, your **CONFIG.SYS** should now remain as you left it, without Win95 'fixing' things for you.

CTPNPSCN.DRV must serve some useful purpose, but I haven't found one, and Creative Labs haven't got back to me on the subject. If, however, you do find some vital functionality missing, reverse the above procedure, and you should be back where you started with no harm done.

While I'm on the subject of CD-ROM drivers in DOS, I should point out that another compelling reason to put **MSCDEX.EXE** into **DOSSTART.BAT** instead of **AUTOEXEC.BAT** (as mentioned in last month's column) is that if a 16 bit CD-ROM driver is already loaded, Win95 will not use its own 32 bit driver. Some CPUs don't like switching between 16 and 32 bit modes, and doing so can seriously degrade system performance. Thanks to Michael Portmann for pointing this out.

Speedy CPU

Someone told me that I could 'overclock' my computer to make it run faster. What is overclocking, and how do I do it? (G. Thompson, via email)

Overclocking is simply running your CPU faster than its rated speed. Contrary to popular belief, there is no structural difference between the different speeds of a given CPU type. A Pentium 133 and a Pentium 166 are theoretically identical, however variations in the manufacturing process mean that not all the chips produced can run at the highest speeds. The manufacturers test all the CPUs after they come off the production line, and give them speed ratings for the highest speed they can reliably maintain, with about a 15% safety margin. Overclocking is the process of exploiting that margin.

Before I go any further, please understand that **overclocking could damage your CPU**, if it overheats due to the increased load. Running a higher speed increases the amount of heat produced, and generally increases the strain on your system. Bad things can happen. Your computer could explode and kill your pets. Well, almost.

I should perhaps add that not surprisingly, Intel and the other CPU makers strongly advise *against* overclocking, and if you read the fine print in your CPU warranty it's probably cancelled if you do overclock.

Now that I'm off the hook, overclocking is a quite straightforward process, and can be done in just a few minutes. The first thing to do is to make sure you have more than adequate heatsinking. You definitely need a CPU fan, even for a 486, and you should really use some heatsink compound to improve heat conduction. (Real petrolheads use Peltier-effect CPU coolers, but it would probably be easier to just buy a faster chip.)

Once you have a nice cool system, dig out the manual that came with your motherboard, and in it you should find the jumper settings that set the system speed. What you want to do is to change those jumpers to the next higher speed setting. For example, if you have a 133MHz chip, you could probably take it to 150MHz without too many problems. Just turn off the power, change over the jumpers, cross your fingers and switch on. If anything abnormal happens while your computer boots (failure to read hard drive, unexplained crashes, smoke escaping...), switch off immediately. Your system just can't handle the higher speed. Put everything back as it was, and your computer *should* still work.

If it all seems to work to start with, but you start getting unexplained crashes later on after the computer warms up, you probably just need a little more cooling. Check that cables don't hamper the airflow inside the case, and find a new sleeping place for the cat. Or move to Tasmania.

For even more information on overclocking, point your web browser at **http://www.sysopt.com** ❖

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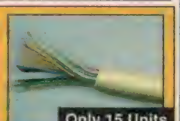

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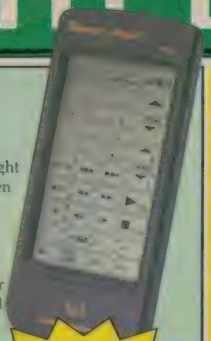

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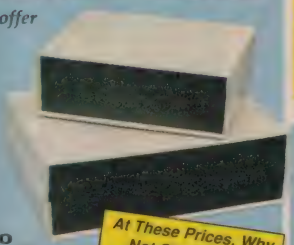

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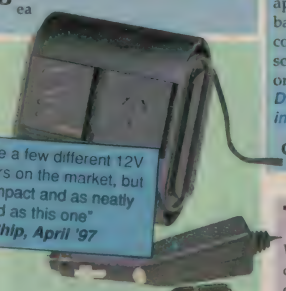

This amazing inverter provides up to 125W of 240V AC power from your car cigarette lighter socket! During our testing, it ran our entire A/V room setup, including a huge 68cm television and surround sound amp! Can power televisions, VCR's, lights, small battery chargers, shavers and hi-fi systems. Features low battery indicator, thermal & overload shutdown and is totally silent when operating. Built-in 3-pin plug (no adaptor required). Includes car cigarette lighter socket lead.

"There are quite a few different 12V to 240V inverters on the market, but few are as compact and as neatly packaged as this one" ***Silicon Chip, April '97***

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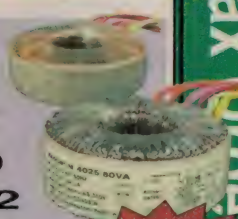

We've got a ***strictly limited*** quantity of these high quality toroids to clear! They're as used in many of our own kit projects and products. Selected voltages available, but be fast, these will go quickly!

TOROIDAL SELLOUT! SAVE OVER 35%!

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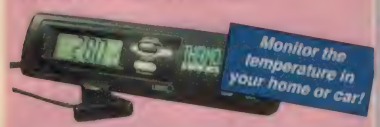

This stylish device features twin thermocouples, one built into the unit, and one on a 3m external lead. The display can be switched between the two sensors, so you can check temperatures inside and outside the office or your home. The backlit display can be switched between °C and °F. Measuring range is -50°C to +70°C. Comes complete with waterproof external sensor and double sided tape.

A 0140 Was $19.95, NOW **$9** ea

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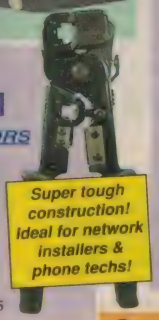
SUITS RJ-45 CONNECTORS



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T 1568 $65

T 1569 Replacement Blade Set $5.95

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BEWARE OF INFERIOR KIT SETS! *The Altronics K 1670 is includes a professional instrument case, including fully silk-screened and punched front & rear panels. PLUS, we've specified a low-radiation, high efficiency toroidal mains transformer.*

K 1670 **$199**

New design features the latest Motorola high power output transistors!!

500W Amplifier Module Kit

HUGE 500W! Great for DJ amps, component subwoofers, instrument amplifiers, even PA systems!

What a Beast! 500W into 4Ω!

(See SC Aug '97) Just the thing to power dedicated subwoofers, DJ, PA or party amps or the like. Silicon Chip claims it's the biggest amplifier ever published in a magazine and they'd be right. *Features* • 500W RMS into 4 ohms , 278W into 8 ohms (-0.3dB @ 20hz and 20KHz) • Input sensitivity 1.43V (at full power into 8 ohms) • Distortion typical less than 0.01% • Signal to noise 117db un-weighted 122db A-weighted • Supplied with the PCB and the components to populate the board, requires a heatsink and power supply *(requires ±80V DC)*

K 5190 **$230**

Video Fader Kit

Add professional wipes & fades to your home videos! Even includes an enhancer to boost the edited signal!

(See EA April '98) Got some home videos you'd like to edit properly for keeps? This useful kit allows you to add basic professional video effects such as horizontal and vertical wipes, fade-ins and fade-outs during your editing. It also includes a built-in switchable signal enhancer so you'll maintain a high picture quality during the process. You'll be surprised just how professional-looking your results can be simply by using this very easy to build kit! Powered by 12VDC plugpack.

K 5875 **$65**

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NEW!

(See SC Apr / May '98) ***ALL NEW REVISED DESIGN!***

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A simple, phantom-powered DI box with super low noise JFET mixer!

(See EA Apr '98) DI Boxes allow you to feed the output from a musical instrument directly into an amplifier without using a mic. This new improved DI unit uses a single JFET amplifier, driving a line balancing transformer, and operates from a mixing consoles phantom power system. It has extremely low noise characteristics, high common-mode rejection and wide dynamic range. It features a 6.35mm jack input, a 6.35mm "loop out" for an instrument amplifier, and a balanced 3 pin XLR output for connection to the mixing desk.

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NEW!

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K 2125 **$16.95**

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Make your own easy to build metal detector!

NEW!

(See SC May '98) Designed as a beginner's project for an introduction to induction based circuits. The unit will detect a source of metal by induction pickup and respond with an audible change in speaker tone. The kit is supplied short form with all of the componentts necessary to construct the unit. Requires a 12V DC supply source.

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Build your own logic probe and save $$$ on commercial units!

(See SC May '98) This fantastic logic probe kit may be used as a basic alternative to a CRO to diagnose digital circuits. Simply connect the probe to a part of a digital circuit, for example the output of a logic gate, and the probe will indicate the status of the signal at that point, ie low, high or pulsing. Commercial logic probes sell for up to $59, build your own and save a fortune!

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Information Centre

by PETER PHILLIPS

Commutators, movie flicker & static electricity

Our first topic takes us back to 1832, with discussion on the Pixii DC generator. We also look at converting movie film to video and ways of solving static electricity problems. As well there's a discussion on charging deep cycle lead-acid batteries.

In November 97, I wrote about my visit to the Deutsches Museum, where I saw the Pixii DC generator, circa 1832. But there's something odd going on. It seems the device I saw is not the device described in at least three old books. The difference concerns the commutator.

While looking at the actual device, I sketched the circuit of its 'commutator' (see Fig.1) — a cam operated switching system made from copper strip. The cam is mounted on the generator shaft and alternately closes and opens switches A and B. I thought at the time it looked rather unreliable and clumsy. But the point is, this is what I saw and sketched.

The first letter on this topic includes a diagram (see Fig.2) of what the writer considers to be the commutator on the machine. He derived it from the illustration in the November issue (see Fig.3).

In your November article about the Pixii generator you included a sketch of it from an old book, but said it showed a commutator instead of a cam-driven switching arrangement.

A commutator is used to switch windings on a rotor to two (or more) stationary brushes. The Pixii generator does not have a rotor with windings on it, instead it has a rotating magnet and the windings are fixed. But for DC output the coil windings have to be switched.

From the sketch, and using a bit of imagination, I have drawn what I think that part of the generator looks like. I've called it an SDFWMRR (synchronously driven full wave mechanical rotating rectifier).

A question: where should the two gaps in the SDFWMRR be in relation to the magnet? I think it should be so the wipers connected to the coils cross the gaps as the magnet's poles face the coils. At this point the flux from the magnet changes from increasing to decreasing (or decreasing to increasing), and the voltage will change polarity.

I hope my observations, assumptions and imaginings are correct about this interesting piece of history. (Kees Lindeman, Allambie Heights, NSW)

Before I discuss your letter Kees, here's the next one. By the way, the diagram in Fig.5 shows the arrangement between the rotating magnet and the generator coils. It comes from a book sent by our next correspondent:

I have a book called Electricity In The Service Of Man. This book was printed (3rd edition) in 1893, and covers the earliest electrical and magnetic experiments: motors, generators, through to telegraph and early telephones. Every detail is mentioned and the formulae etc are still used today. I've enclosed a photocopy of the pages that describe the Pixii generator.

For interest, I would like the following answered, as (I think) these questions have never been properly explained. We use magnetism, we know basic theory about it, it's a natural force with an untouched potential. But what is it? Is it a frequency? And how did the Earth's north and south magnetic poles originate? (Ted Sherman, Kawhia NZ)

A few more questions to answer, but first let's get on with my problem about the Pixii generator. As you can see in Fig.2, Kees' drawing of the 'commutator' agrees with that from the book sent by Ted (see Fig.4). The illustration of the generator in Fig.3 is also from Ted's book. Interestingly it's the same as the illustration I included in November, except mine came from a *different* book, which I described in *EA* May 1990. The book, titled *Magneto and Dynamo Electric Machines* was published in 1884, nine years earlier than Ted's book. And, as the following letter explains, yet another book says the same as the two I've just mentioned:

I'm intrigued about the Pixii generator. It seems you might have seen the first version, and that Pixii, realising the deficiency of his 'commutator', later constructed another with the commutator arrangement shown in the illustration in the November issue.

In my copy of English Mechanic and World of Science, September 14, 1883, No.964, page 30, Bottone says: 'The first machine constructed after Faraday's discovery was that of H. Pixii, in 1832'. He goes on to describe the machine as pictured by you, except he mentions only two brass springs pressing against a rotating split collar of brass, calling it a commutator.

He also says that in 1833 Mr Saxton had the happy idea of fixing the heavy magnet and rotating the lighter armature. So by 1833 there were two-pole dynamos with two-segment commutators and a permanent magnet stator. Mr Gramme went on to fame when, more than 30 years later, he found a way to expand these numbers. (Gordon Wormald, Florey, ACT)

So, as you suggest Gordon, perhaps there's another Pixii generator somewhere, and a later version than the one in the Deutsches Museum.

Or have the books have got it wrong? For example, I wonder if the author of Ted's book ever saw the Pixii generator, and instead, like Kees (who admits to limited electrical knowledge) worked out the 'commutator' arrangement from the drawing of the generator. This drawing had obviously been around for some time, at least since 1884.

The generator I saw is more primitive than that in Fig.3. Unfortunately my photos of it did not turn out, but my video of it did. I'll try and extract a still from the video and include it in the column.

You can probably see why I'm so keen to get to the bottom of this. We've known about the existence of electricity for centuries, but electricity as we know it today really started with the first practical DC generator. We cannot say it started with Faraday's discovery of electromagnetic induction. While an essential discovery (and one I don't want to minimise), it did not in itself produce electricity — it was simply a concept.

So, to me, the 'holy shrine' of electrical power is Pixii's DC generator, the first practical device to convert mechanical energy to electrical energy. And it seems it *is* the first, if this extract from Ted's book is correct:

The First Magnetic-Electric Machine — The discovery of induction by Faraday, in 1831, gave rise to the construction of mag-

neto-electro machines. The first of such machines that was ever made was probably a machine that never came into practical use, the description of which was given in a letter, signed 'P.M.', and directed to Faraday, published in the Philosophical Magazine of 2nd August 1832.

Returning to the questions posed by our writers, the switching should occur when the magnets are at their *maximum* distance from the coils, Kees, not when they are near the coils. The polarity of the voltage changes with the polarity of the magnetic field, which occurs away from the stator poles. This also means the switching occurs when the output from the coils is passing through zero.

As for explaining what magnetism is Ted, I have no idea! I can tell you lots about it, but magnetism is as much a mystery to me as gravity. Your suggestion of frequency seems wrong — but then, I don't know. As far as I know, magnetism is not really understood by anyone. The origin of the Earth's magnetic poles is also something I know very little about. I do know there is some concern that these poles could reverse, at least according a promo for a TV program I unfortunately missed. Now back to the present day...

Static electricity

In February, I included a letter from a reader anxious to solve the problem of static electricity in his workplace, caused by nylon carpet. This letter describes a similar problem, and how it was solved:

Your reader's problems with static electricity from the carpet in his workplace reminded me of a problem we had 10 or so years ago. As you suggested, we solved the problem with an antistatic solution.

At the time, I was involved in installing and running an instrument known as a nuclear resonance spectrometer, the major components of which comprised a computer and a superconducting magnet. The magnet, to remain superconducting, had to be kept at a very low temperature, and was immersed in liquid helium surrounded by a jacket of liquid nitrogen, all in a very large dewar flask. It was necessary to have very low humidity in this room, achieved by using suitable air conditioning. Otherwise, the low temperature liquids (gases) caused ice to form and block the outlet vents, which could lead to an explosion.

However, because of the low humidity we all built up static charges, which meant touching any metal part of the computer would immediately scramble the software. With the help of a carpet expert, we were able to come up with a suitable antistatic solution (the name of which I've now forgotten) to solve the problem. I hope this experience is useful. (Andrew Nisbet, Dunedin NZ)

I've heard of antistatic carpet sprays, so I guess it's a question of finding one that does in fact work. Clearly this is an answer to the problem, as you've pointed out Andrew. And in your case, the problem had to be solved so work could continue.

The next letter makes another suggestion on solving the problem:

Your February correspondent should be aware that it takes two to tango. The static charge is usually built up by the combination of nylon carpet and the person's clothing — especially, I suspect, trousers. Artificial fabric enhances static build up, so perhaps changing to cotton trousers could help. If not, try wearing a cotton shirt as well.

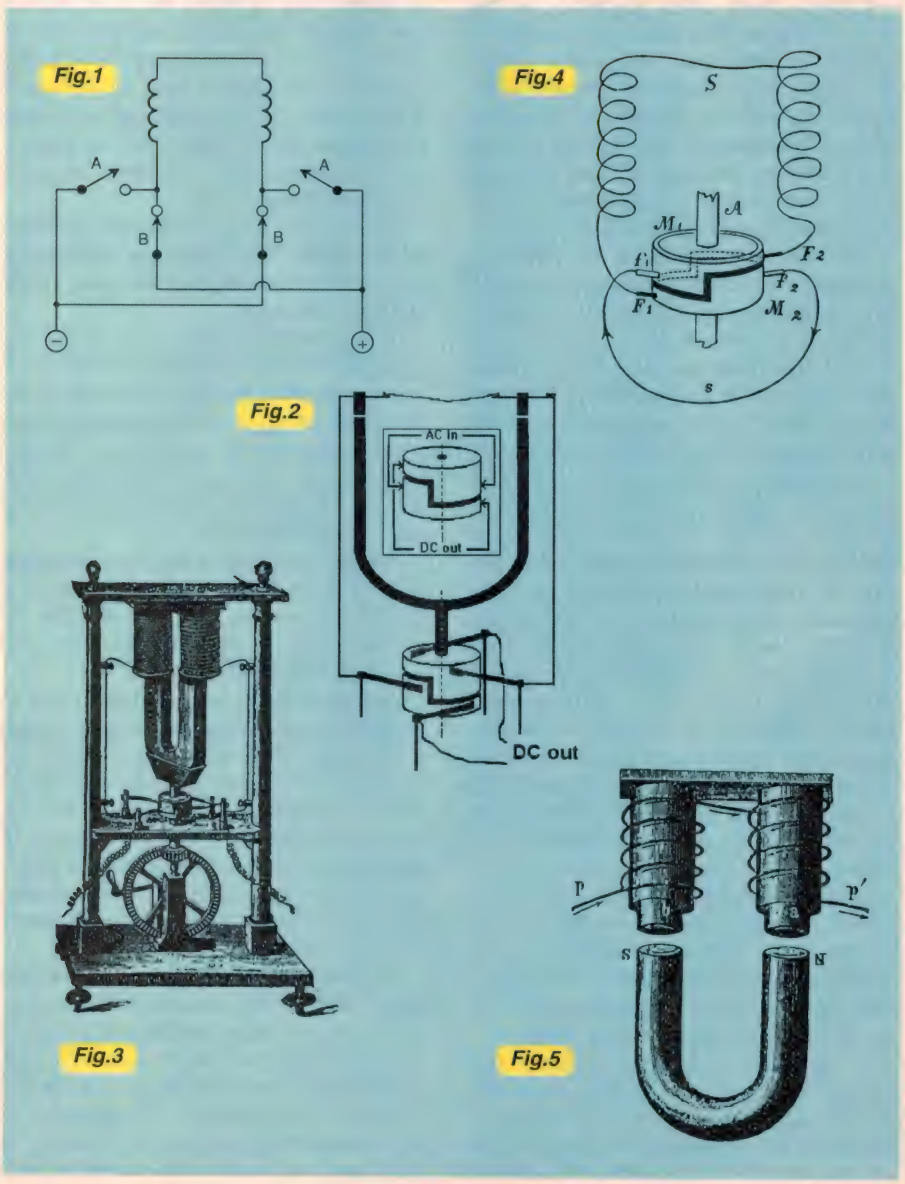
It's quite easy to test this on a low humidity day. Use a metal object such as a key held in the fingers to test for a spark to some metal fixture — change the clothes and try again. (Ray Darnell, Richmond Hill, NSW)

Good point, Ray. Artificial fabrics are renowned for this, so it's worth trying.

Super 8 to video

A reader asked in the January column about the apparent absence of 'out of sync' bars when a Super-8 movie is filmed by a video camera. Here's the first of a few letters I've received about this:

Regarding the lack of flicker when home movies are transferred to tape using a video camera, the process is somewhat as follows. Frame one from the projector is focused via the camera lens onto the faceplate of the camera tube (a vidicon type in older cameras, or a CCD device). Such devices do indeed have a memory (as your editor suggested) in so far as, in simple terms, they retain the pattern of electrical charge imparted by the focused image until scanned, in a vidicon for instance, by



the TV scan rate electron beam.

From the projected image, TV frame one-field one (the odd scanning lines) will produce a video picture. So will TV field two (the even lines). If the projection rate is 18 frames per second and the TV rate is 50 fields per second, when TV frame two-field two starts scanning, the projector may be in its blanked-out period as the next film frame is pulled into position. Therefore TV frame two-field one (or part thereof) will be blank. When the next film frame is projected onto the camera tube, it may have commenced scanning TV frame two-field two, which will again produce a video picture.

The net result is that every so often one of the video fields (or part thereof) will be blank. However, when displayed on a picture tube, the persistence of vision of the eye will fill in the blank field gaps with its own 'memory' of the preceding field, and the gap won't be noticed. In fact there will be a slight but not objectionable brightness variation, at a frequency related to the difference between the projection and the TV rates.

Channel 2 in Melbourne, where I worked for many years, at one time had an RCA vidicon colour telecine chain. The 16mm projector was driven by a mains operated motor at a nominal 25 frames per second, hence it was not synchronised to the TV frame rate. Because of the aforementioned lag characteristics of vidicons, there was no visible out of sync flicker.

Quite acceptable transfers can be made of home movies projected onto a matt white screen, say one metre in front of the projector (to get a bright picture), with the video camera pointing at the screen, and set up as close as possible to the optical axis of the projector to avoid keystoning. Don't forget to do a white balance while the projector is screening an open gate, before you start.

The obverse case, where a cine camera photographs a TV image from a picture tube, is quite different. In this instance, because the picture tube has a very short persistence, if the camera shutter opens when the scanning beam is part way down the screen, the film image will be dark above that point. This results in the familiar horizontal shutter bars that wander though such non-synchronised film images. (Ken Simpson-Bull, Glen Waverley, Vic)

Thanks for this information, Ken. I thought there would be some sort of 'memory' involved, but I didn't think it would be the eye. But there could be other factors involved as well, as the next letter points out:

I too have converted Standard 8 and Super 8 home movies to video, using a Eumig projector. The point you've overlooked is that while the Super 8 film runs nominally at 18 frames per second (fps), the projector has a three-blade shutter, so the obscurations are at 18 x 3 — 54fps. This projector has a speed control, so reducing its speed will eliminate any strobing effects.

The Standard 8 at 16fps x 3 (48fps) plus a small increase in projector speed does the job. Regarding 16mm, sound films run at 24fps with a two-blade shutter. The Bolex 16mm projector has a switch to allow selection of a two or three blade shutter, so combined with a speed control, can easily be adjusted to handle transfer to video. (Len Ryan, Mudjimba, Qld)

Having read these two letters, I'm tempted to pull out my old Eumig projector and convert my home movies to video. It seems there are all sorts of reasons that prevent the flicker, including an almost similar 'frame' rate from a Eumig projector. But, according to our first letter (and the letter that started this topic), you don't see the flicker in the first place, so how can you adjust the projector speed to eliminate it? Still, it seems it doesn't matter anyway. Now where are those old movies of the kids?

Fig.7

by Pythagoras':

$AC = \sqrt{12^2 - AB^2}$.... (1)

and

$BD = \sqrt{10^2 - AB^2}$.... (2)

using similar triangles:

$XB = \frac{5AB}{AC}$.... (3)

and

$AX = \frac{5AB}{BD}$.... (4)

summing (3) and (4):

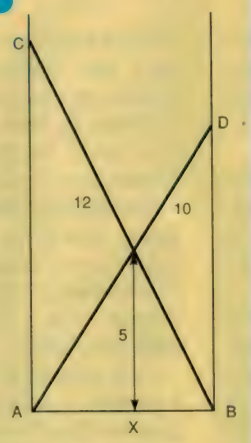
$AB = \frac{5AB}{AC} + \frac{5AB}{BD}$.... (5)

dividing both sides of (5) by 5AB:

$\frac{1}{AC} + \frac{1}{BD} = \frac{1}{5}$.... (6)

substituting (1) and (2) in (6):

$$\frac{1}{\sqrt{12^2 - AB^2}} + \frac{1}{\sqrt{10^2 - AB^2}} = \frac{1}{5}$$



Deep cycle batteries

Continuing with a topic started in November, here's a letter that explains why it's sometimes difficult to charge a deep cycle battery — the resistance of the connecting leads.

I don't think you answered R. Gebhard's question on charging the battery in a caravan by the vehicle charging system. I have asked this question before of EA, without getting an answer. The problem seems to be the voltage drop from the charging source to the battery in the van, which could have a round trip of 10 or 15 metres. You can't use a large cable and still use standard plug and socket connections.

There are devices available that can be connected at the van end to boost the voltage to charge the battery. However, these appear to put the horse after the cart, as you are trying to boost the voltage that has already lost out to voltage drop. Wouldn't it be better to boost the voltage at its source? Perhaps you might consider a construction project for this. Many thanks for a fine magazine. (Cliff Wylie, via email)

As you say Cliff, a few ohms of resistance in the connecting cable would be enough to cause a voltage drop that would limit the charge current. Still, there has to be a current to cause the voltage drop, so there must be some charging taking place. But not enough, it seems. Mr Gebhard didn't include details of his cabling arrangement, so I can't be sure if this is causing his problem.

Your suggestion of boosting the charge voltage at the source seems reasonable. However, there might be practical difficulties mounting the booster in the car. As well, it doesn't overcome the voltage drop, so I guess it doesn't matter which end the booster is placed. What appears to be important is that there is a booster. We'll see what we can do to develop a project for this. It seems a popular request.

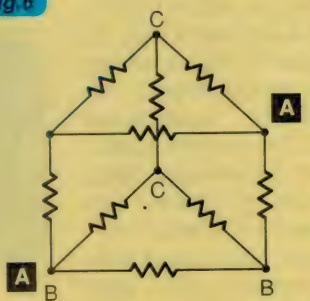
What??

This month we get back to electrical basics, with a good old resistor network. The question was sent to me by Graham Johnson (Keilor East, Vic) who asks:

A space frame with the shape of a triangular prism is made by soldering nine 1Ω resistors together as shown in Fig.6. What is the resistance between points A-A, B-B and C-C?

Start by finding the resistance between C-C. Just a hint!

Fig.6



all resistors one ohm

Answer to April's What

The final equation and its derivation are shown in Fig.7. To solve the equation for AB in the last equation, Roger used 'a short clumsy substitution program written in humble BASIC'. He found that AB = 4.29732 feet. ❖

Moffat's Madhouse

Wheeled music — *of sorts*

Whoom. Whoom. Whoom. What's that coming down the road? Whoom-thump-thump-thump Whoom-thump-thump-thump. It's getting closer...

WHOOM-THUMP-THUMP-THUMP! WHOOM-THUMP-THUMP-THUMP! Now it's right upon us. Is it a sonic boom? Is it a pile driver? No. It's a car stereo. That's not quite right. It's a stereo on wheels.

Is it like this in Australia? You're sitting there at the traffic light and this big mean-lookin' car pulls up next to you, and there's this mean-lookin' guy sitting in it, and the whole works is going WHOOM! WHOOM! Bass notes, probably part of rap music. Should the car's windows be open, you will hear words that make a sailor blush. All part of the image.

I clearly remember the first time I encountered one of these rolling boom-boxes. I'd just arrived in America, and was on a road trip to my new home in Port Townsend, Washington. We were in a campground in Colorado Springs. It was a warm night, and we were sitting outside near a stream that ran through the campground. And along came WHOOM! WHOOM! from the road above the campground.

"What the hell is that!?" I really didn't have a clue. An earthquake? Had somebody nuked the US Strategic Air Command headquarters inside Cheyenne Mountain?

Then this low-slung black car came by, shaking and vibrating. It was music! (?)

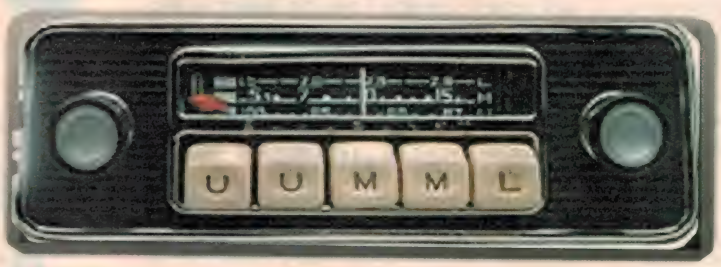
Permit me to quote from this morning's Dave Barry column in the *Peninsula Daily News*: '...the aggressive young male whose sound system is so powerful that the driver must go faster than the speed of sound at all times, otherwise the nuclear bass notes emanating from his rear speakers will catch up to him and cause his head to explode.'

Is this phenomenon new? No way. This may be another Moffat's Madhouse 'first'. Back in the early sixties, in Albuquerque, I owned a flashy little car called a Karman Ghia, which was basically a Volkswagen Beetle with a sports body. They are now nearly extinct — as far as I know there was only one Karman Ghia still alive in Hobart, at least while I was living there. But here in Port Townsend I know of at least six of the things, in a town of 8000 people. How strange...

The Karman Ghia was primarily a two-seater, with a tiny back seat which might hold two very small kids if you were lucky. And behind the back seat, and below the rear window, was a carpeted well where you could store things.

I was working at a hifi shop back then, and I decided I should lash out and buy the Karman Ghia the very best car radio on the market, at a nice employee discount. That turned out to be a Blaupunkt model, with AM, FM and even shortwave. This was in the days before transistors existed, so car radios used valves. Most were powered the usual 150 volts or so, delivered by a 'vibrator' power supply. (Anybody remember those? Awful things...) But the Blaupunkt had no vibrator; instead it had valves that ran directly from a six- or 12-volt battery. In other words, six volts on the anode. Don't ask me how they did that. All I know is that it worked. It was a fantastic radio.

Before long I decided that the radio deserved something better than the little speaker in the dash. So I built a sturdy plywood enclosure, designed as an exact fit for the parcel well behind the Karman Ghia's rear seat. I got two 8" full-range speakers of the very highest quality, and mounted them into the enclosure facing straight up, so the sound would reflect from the rear window. Since there was no such thing as stereo FM in those days, the speakers were wired in parallel, presenting a four-ohm load to the Blaupunkt radio.



Tom's original valve-era Blaupunkt.

That was one very nice car sound system. It didn't thump; instead it produced a wide range of bass and treble, all correctly balanced. I liked to listen to one particular rhythm and blues FM station; big bass guitar, and kick-drum, both clearly discernible as they should be. And on AM, Wolf Man Jack, from his mighty transmitter over the border in Mexico. My young lady friends thought this was the coolest thing on four wheels. All part of the image...

The Karman Ghia eventually met its demise on a snowy mountain road, the victim of a sloppy young driver (me) who was following too close and smacked into the rear end of the car in front. The Ghia's body was made of aluminium, and it crumbled like a crushed beer can. Off it went to the wrecking yard, complete with Blaupunkt radio and fancy speaker system. I never saw either of them again.

Move to Oz

A few years later: Australia, 1968. Wide open spaces, big distances to travel, few radio stations other than in the cities. Car radios with names like Astor. FM broadcast was still years away, so those radios were AM-only. But did they ever go! I was living in Melbourne back then, and I remember being totally impressed by how those Australian car radios performed. It was possible to drive around Melbourne (providing you weren't near tram lines), hearing stations from places like Geelong and Albury and Wagga, right in the middle of the day. This was completely out of the question in the USA; hearing an AM station 100km distant during the day was considered a big deal.

After driving various junkheaps for a while, I decided I could afford a new car, which turned out to be an Austin 1800 ute (big mistake, but that's another story...)

Many new cars, such as the Austin, didn't come with radios as standard back then; they were considered an unnecessary luxury. So I decided to buy a really nice car radio — an HMV, which was one of

the more expensive models. It was one truly hot radio. I soon discovered it was possible to escape Melbourne's Saturday football mania by tuning the HMV to 7BU in Burnie, at least 300km distant. It came in just like a local.

At long last, FM broadcast arrived in Australia, and suddenly car radios had a whole new duty to perform: deliver sparkling FM sound, in stereo. Most signals were radiated by whopping transmitters sitting atop mountains like Mt Dandenong and Mt Wellington. Signals could be received anywhere in the cities on the proverbial piece of wet string. So FM car radio design could concentrate more on the audio end of things, rather than RF. If the FM signal fizzled out as soon as you left town, then so be it. You're out of the station's primary service area anyhow — you're not SUPPOSED to hear it.

I resisted an FM car radio for a long time, mostly because of the cheapskate factor. I still had the HMV set, by then transferred from the Austin (which went into early forced retirement) into a Volvo that we bought brand new, again minus radio. I contented myself for several years with AM-only, but finally the FM bug bit. So off I went shopping, with my Bankcard and high hopes.

That turned out to be a big mistake. I ended up with a car stereo that produced a fine sound driving around Hobart. But it was as deaf as a doornail when it was out of sight of Mt Wellington. While it was near my home, on the slopes of the mountain close to the transmitters, it heard lots of FM, and television — all at once, all over the dial. And no matter where you were, the AM was a joke. What a dud!

So — a move back to the USA, and the purchase of a small Dodge Ram pickup truck (ute) which came equipped with a Fultron car stereo driving a pair of Krako speakers. Fultron is a maker of those mega-systems mentioned above; the radio in the truck was obviously the baby of Fultron's range. The speakers were tiny 2-1/2" units in little plastic enclosures, hung beneath the dash with one screw each. Hitting a big bump, or just routine vibration, sometimes caused one to fall off and swing around happily on its connecting wire.

Given the crummy speakers, the thing didn't sound too bad. Or maybe I just got used to it. What was impressive was its RF performance. On our first cross-country trip in that truck, we'd be out in the wide-open spaces of Montana or somewhere, and there'd be plenty of AM and FM stations to listen to, even though the nearest town could be 100km distant.

Here in Port Townsend, we have an interesting radio situation. There are no local AM or FM stations. However we are at the centre of a triangle roughly defined by Victoria BC (50km distant), Seattle (60km away) and Vancouver BC (100km). Each of these cities has numerous AM and FM stations with powers ranging from 1kW to 100kW.

As far as I can tell there has been international cooperation so that no two of these stations are on the same frequency. But just about every channel contains something, and adjacent channels can have signals of wildly varying strength. Even more so when you're driving amongst the many hills and valleys in the area.

And the new all-singing stereo Blaupunkt — a beauty!

My favorite FM stations are mostly the non-commercial ones or National Public Radio, and these are generally less powerful than the big commercial broadcasters. Within this setting the Fultron radio didn't do a bad job. I could punch up a public station from the radio's memory and drive just about anywhere with very few fades. AM-wise the radio was less able, battling to pull in the weaker stations.

Back to a Volvo

Enter upon the scene one 1986 Volvo station wagon, former property of my father who has grown too old to drive. So I'm now a Volvo driver (again). If cars have gender, then Volvos are definitely female. Mine is a rather attractive middle-aged lady who still knows how to boogie. We get along well.

There are lots of Volvos in Port Townsend; it's said that this is the place where old Volvos come to die. Most of them are driven by women (*real* men drive monster pickup trucks, while spitting out the windows).

My Volvo came to Port Townsend from Albuquerque, rolling along the freeways with the cruise control locked at 80 miles an hour. All the time, the radio was going flip-flutter-flop-fop as FM signals jumped in and out. AM was mostly a quiet hiss. In Port Townsend, only the strongest stations were audible, and in those valleys...

The final straw came when I was driving to a nearby town, through the usual valleys. The result of a very controversial court case was running live on one of the stronger AM stations, but all I heard was "The judge has just returned to the courtroom. And here comes the decision... in light of all the evidence presented, I now sentence you to (sizz.. pop! fade...)."

The factory-fitted radio had to go. Fair enough, it was 12 years old and it had done its time. I wasn't going to swap the Fultron out of the truck, because it was failing too.

So the search began, on the Internet, for a replacement. Clarion looked very promising, but the winner was — Ta DA! — another Blaupunkt. We'd gone full circle from 35 years before.

My online study suggested that most manufacturers were concentrating on audio matters — multiple speakers, faders, equalizers, CD players, and whopper amplifiers. The 'radio' part is only secondary to playing pre-recorded music with enormous acoustic power while cruising the main drag. I'm starting to think this 'whoom-whoom' is some kind of mating call.

The Blaupunkt isn't all that impressive to look at, but the specs make a big deal about the red-hot tuner with special multipath cancelling features and gradual switching from stereo to mono as FM signals are degraded. As for the audio, a screaming seven watts per channel RMS, but who needs more?

The receiver seems to have enormous dynamic range, so it can handle the weak signals amidst the whoppers. For example, there's a truly scrawny Canadian public FM station on 90.1MHz. It's inaudible on the Fultron, a mish-mash of many stations on my trusty Sony portable, but loud and clear on the Blaupunkt.

That radio is perfect for the RF environment where I live — but is such performance needed in Australia, where the bands are not so crowded? Maybe so, maybe not. One place where a sooper-dooper car radio might be handy is in the back blocks of Tasmania, where radio reception is so bad you sometimes have to give up and switch off. Or play a cassette...

Blaupunkt doesn't seem to be that well known in Oz. A search of the Australian yellow pages revealed only one Blaupunkt source, in Canberra. Whatever you do, DON'T be tempted to order a fancy car radio from the USA, because the AM tuning will be all out of whack — 10kHz steps instead of 9kHz. Wouldn't *that* drive you mad! ❖

Electronics Australia is one of the longest-running technical magazines in the world. We started as *Wireless Weekly* in August 1922 and became *Radio and Hobbies in Australia* in April 1939. The title was changed to *Radio, Television and Hobbies* in February 1955 and finally, to *Electronics Australia* in April 1965. Here's some interesting items from past issues:

50 years ago

May 1948

Large Screen Television: In a paper presented before the Society of Motion Picture Engineers, RCA engineers revealed that they are now able to project pictures 18 by 24 feet — larger than the average motion picture screen — and with a degree of highlight brightness meeting professional motion picture standards. The projection distance is 40 feet.

RCA's new projector uses a 15" cathode ray picture tube operating at 80,000 volts, and an optical system employing a 42-inch spherical mirror and a 36-inch correcting lens. This is the largest Schmidt-type optical system in actual operation in the world.

Midget Valves: Valves so small that three of them will fit comfortably in a teaspoon have been developed by Mullard. They will be used in the state-sponsored 'Medresco' hearing aid, and an initial order for 400,000 of them has been placed by the British Government.

The valves are 10mm in diameter, the lengths being 30mm for the DF70 voltage amplifying pentode and 38mm for the DL71 and DL72 output pentodes. The lead-out wires are tinned to facilitate soldered connection into the circuit.

25 years ago

May 1973

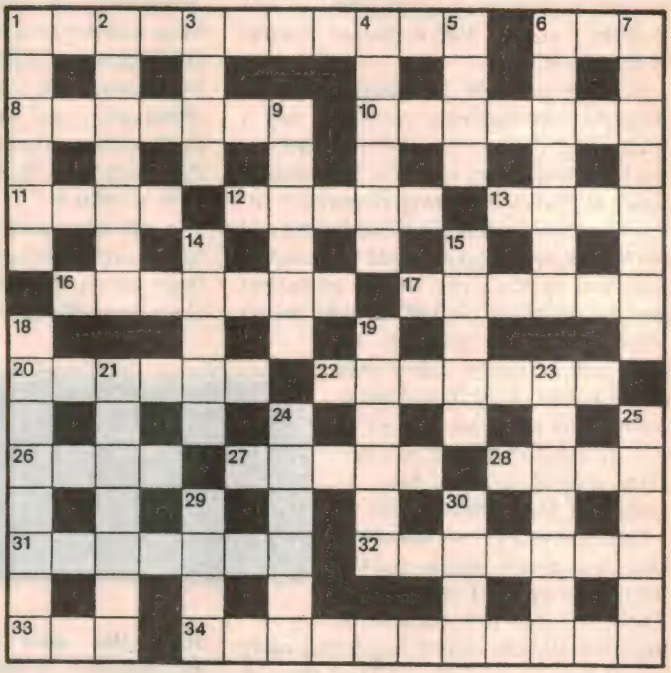
New Phone has a Memory: A telephone than can automatically dial a call to anywhere in the US at the touch of a single button has been developed by engineers at Bell Laboratories. The new 'Touch-a-matic' set is claimed to be the first telephone with a solid-state memory. It is capable of dialling any of 31 numbers, all of which are recorded by the user and may be changed as required.

The memory of the Touch-a-matic set is made up of 10 LSI microcircuits which contain the equivalent of 15,000 transistors. Since solid-state memories of this type need a constant power supply if their information is not to be lost, nickel-cadmium batteries are incorporated in the set as a standby power source.

Device Recognises Pattern Defects: A new type of defect recognition device has been developed by Hitachi Ltd in their Central Research Laboratory in Tokyo. The device can automatically detect defects in complicated patterns such as those for LSI microcircuits and large printed wiring boards, yet does not rely on comparison between the pattern being checked and a 'normal' reference pattern fed into the system beforehand.

Instead, a defect-free normal pattern is generated in real-time mode directly from the input pattern itself. ❖

Crossword



Across

1 Interest of this magazine's readership. (11)
6 Digital voltmeter. (1,1,1)
8 Inverter circuit. (7)
10 Said of electric current. (7)
11 Simple coaxial conducting arrangement. (4)
12 Two times. (5)
13 George the pilot? (4)
16 Part of a numeric display. (7)
17 Adjustable control on electronic organ. (6)
20 Historic British film studios. (6)
22 Part of the Internet. (7)
26 TV award. (4)
27 Set of variable attenuators. (5)
28 Suggestion. (4)
31 Turned on an axis. (7)
32 Hard, dense metal discovered in 1789. (7)
33 Hard disk drive. (1,1,1)
34 Ratio of charge to potential. (11)

Down

1 Key of computer keyboard. (6)
2 Hard insulating material. (7)
3 Use machine first produced in 1870s. (4)
4 Influence charge to move. (6)
5 Energy drain. (4)
6 Remove from mounted position. (7)
7 Very small unit of current. (8)
9 Repair to a motor. (6)
14 Firm distributing test equipment and instruments. (5)
15 Fraction of a wave cycle. (5)
18 Scientific study. (8)
19 Grid of fine lines. (6)
21 Confined by a boundary. (7)
23 This is provided by programmed learning systems. (7)
24 Said of new type of radio for the third world. (4-2)
25 Present a difficult problem. (6)
29 US colour television system. (1,1,1,1)
30 Unit equivalent to a Joule/second. (4) ❖

April's solution:

H	A	L	O	G	E	N		F	O	G	H	O	R	N
A		A		R		I		I		R		P		O
C	O	N	V	E	R	T	E	R		I	D	E	A	L
K		D		Y		R		S		D		R		O
E	X	I	T		N	I	N	T	H		G	A	I	N
R		N		T		C		A		C		N		G
	I	G	F	E	T		D	I	S	L	O	D	G	E
C				L		P		D		O				R
O	V	E	R	L	O	A	D		B	U	L	B	S	
M		L		Y		R		R		D		A		S
P	L	A	Y		B	A	S	I	C		F	L	A	T
U		S		G		L		B		F		L		A
T	U	T	O	R		L	U	B	R	I	C	A	N	T
E		I		A		E		O		L		S		I
D	E	C	I	M	A	L		N	E	M	A	T	I	C

Electronics Australia's

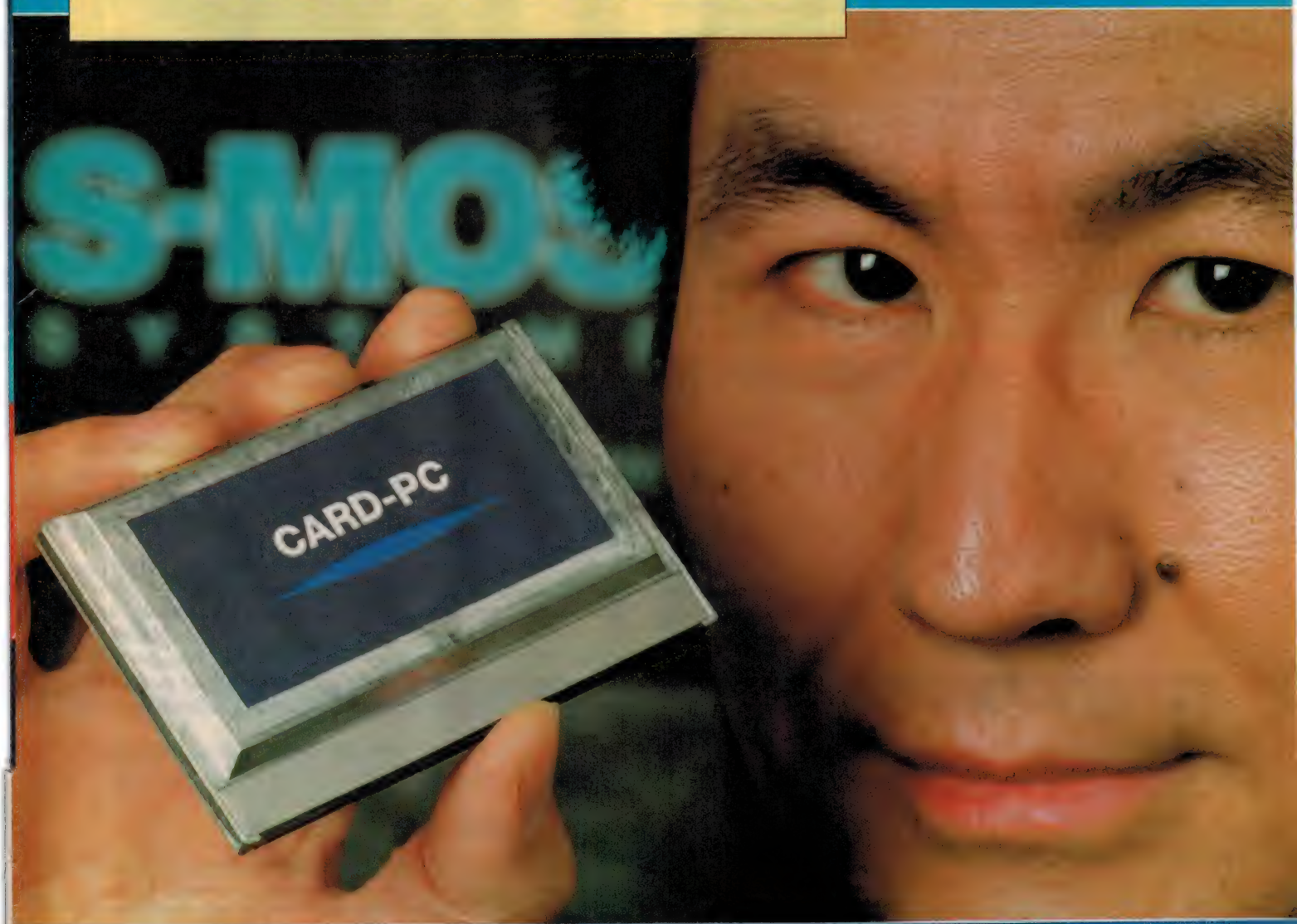
Professional Electronics

Dick Smith Electronics launches 'Built To Order' personal computers

National Semiconductor claims smallest-ever op-amp for cellphones

Neutrik's A2 state of the art Audio Test Set reviewed

LINUX: What it's All About, Review of Red Hat Linux V.5



Smallest PC 'motherboard'? Seiko Epson affiliate S-MOS Systems shows its new engine for handheld, portable & mobile PCs — with 133MHz CPU, up to 32MB DRAM, SVGA & I/O on board!

highlights News

National claims smallest op-amp

National Semiconductor has introduced a new integrated circuit so small that the packaged device is about the size of a flake of coarse-ground pepper. The tiny package houses an operational amplifier (op-amp), for use as a basic building block in a wide variety of electronic systems ranging from cellular phones to full-size computers.

The new chip, identified as the LMV321, is claimed as the industry's smallest ever op-amp and is the first device to be packaged in the miniature SC70-5 package. This package measures only 2.0 x 2.1mm and has previously been used only to house discrete devices such as single transistors.

The new chip also operates at voltages from 2.7 to 5 volts, which reduces power consumption and extends battery life. These characteristics make the device ideal for use in cellular phones, cordless phones and pagers.

Digital servers help sink Titanic

200 of Digital Equipment Corporation's AlphaServers were used 24 hours a day for two months, to sink the Titanic and raise the level of realism for the blockbuster movie *Titanic*. Production studio Digital Domain Productions used the AlphaServers to generate all special effects for the Golden Globe-winning feature film.

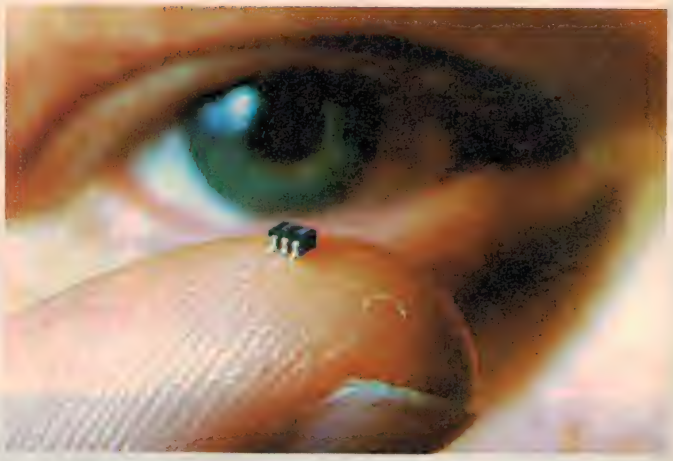
"Virtually every frame of *Titanic* was processed by an AlphaServer", said Daryll Strauss, software engineer at Digital Domain Productions. "We quickly realised the Digital Alpha-based systems served our batch-processing needs very well. They provide extremely high floating-point performance in commodity packaging."

Only a small portion of the Titanic was modelled to full-scale for the movie. Miniatures were used for the remaining scenes. To these models, Digital Domain added other elements of the scenes, including ocean, waves, people, birds, smoke, and other details to make the models appear to be docked, sailing or sinking.

Digital Domain's AlphaServers were running Red Hat Linux, a Unix-like operating system designed and produced by Red Hat Software, a North Carolina research firm.

"We found Unix limited in the extensions we needed", said Mr Strauss. "We couldn't communicate with our NT-based file servers, connect two unusual varieties of tape drives or allow large numbers of users on a single system. Linux fulfilled this task very well."

The movie *Titanic* has received 10 Academy Awards. This includes the award for special effects. Digital Domain has been creating special effects for Hollywood movies since 1993. Their feature credits include *The Fifth Element*, *Interview with the Vampire*, *True Lies*, *Apollo 13* and *Dante's Peak*.



Protel goes direct

Protel International, leading developer of Windows-based electronic design software and originally founded in Australia, has announced the establishment of a Worldwide Direct Network to make easy-to-use and easy-to-afford electronic design tools available to every electronics designer. The Worldwide Direct Network will deliver information and products directly to design engineers, eliminating the regional inconsistencies that can result from traditional distribution arrangements.

Nick Martin, company founder and CEO explained: "The philosophy behind Protel's Worldwide Direct Network is a belief that all designers must be able to easily access the best electronic design tools if the industry is to continue seeing great innovation and advancement."

"One factor which may have prevented this for designers in many regions in the world is affordability. Although most agree that the world should now be considered a single market, the EDA industry has been slow to respond and has maintained highly variable pricing of certain products in different economies."

"Protel International will address this issue by offering affordable products directly to designers throughout the world."

Protel plans to establish regional offices in key territories and locate the electronics designers in those areas, then supply information and products directly to those design engineers. This is an approach that has proven very successful in the recent marketing of the Protel 5-Pack, and Protel is expecting similar success with the marketing of its latest release, Protel 98.

For information about Protel International and its products visit **http://www.protel.com**.

DSE launches 'built to order' PCs

In what it claims is a first for Australia, leading consumer electronics retailer Dick Smith Electronics has launched its 'Built To Order' (BTO) computer program in all stores. The company's customers can now order a DSX-brand PC built to their own specifications and have it delivered anywhere in Australia within eight working days.

Ordering is facilitated by a company-developed 'configurator' software program which runs on a PC in the store, but is linked online with the factory. Customers can firstly select a base configuration, then customise the PC by choosing from a range of components on the easy to follow on-screen menu. As a new com-

ponent is selected, the price updates automatically. There are thousands of possible combinations.

Once the customer is happy with the selection, the order is sent through to the store's point of sale register for payment. Customers may elect to pay in full and have the PC delivered direct, or pay 50% when placing the order and the balance on collection of the PC from the store. All BTO PCs will come with a standard three-year return to base warranty, with additional on-site warranty options available at time of purchase.

Targeting a wide range of customers, Dick Smith Electronics is to offer the new service through its 85 company-stores and Direct Link mail order service throughout Australia. Finance is also available to approved customers through AVCO and RentSmart.

BTO Computer ordering will also be available through the company's website, which is in the process of being relaunched with Dick Smith Electronics' entire catalog of products available on line.

"International trends toward customised PCs have led to changes in consumer expectations", said Dick Smith Electronics MD Jeff Grover. "Our aim is to make buying a computer easier for our customers, who have indicated they want a PC that suits their individual needs."

"Dick Smith Electronics' BTO Computers concept goes one step further than our competitors", added Mr Grover. "It offers our customers a competitively priced customised PC within the security of a well respected retail environment."

Melbourne-based EMC Technologies, appointed by the ACA as a competent body under the EMC Framework, has added a TCF compliance facility to its range of NATA accredited testing services. The company will have a stand at NEPCON '98, held at Darling Harbour Exhibition Centre May 26-28.

Sanyo & Pacom team up for CCTV

Pacific Communications ('Pacom'), which has operated at the forefront of the local CCTV and security industry for more than 25 years, is to distribute and supply Sanyo CCTV electronic security products. Pacom has successfully completed some of the nation's largest and most complex security projects including sporting venues, casinos, commercial sites, prisons and railway stations.

"For some time now we have been looking at forming a strategic alliance with a supplier of quality security products. Sanyo's range of equipment dovetails well with our existing security surveillance products", said Sandy Beard, Pacom's CEO and Managing Director.

Colin Doyle, from Sanyo, added "We are delighted to be able to supply our electronic security equipment through such a prestigious company as Pacom. Pacom is an Australian company leading the field in the world marketplace. We believe that the future relationship is a marvellous opportunity for both Sanyo and Pacom to advance the CCTV industry in Australia."

Groups agree on global CDMA standard

At a meeting in February held in Japan, the European Telecommunications Standards Institute (ETSI), Japan's Association of Radio Industries & Business (ARIB), the Korean standards body TTA and the United States TIA (Telecommunications Industry Association) TR 46.1 formally united behind a single wideband CDMA standard for the International Telecommunications Union's IMT 2000.

The new 3G standard will provide wireline-quality voice, high speed data, multimedia and efficient mobile internet access at data rates up to 5Mb/s, and will allow for the much anticipated global roaming.

According to Professor Donald L. Schilling, chair of the United States TIA's 46.1 and chairman of Gold Bridge Technology, "We expect that in the interest of achieving this global standard and not compromising at the lowest common denominator, we will achieve the highest performing wideband CDMA 3G system". Golden Bridge Technology (GBT), headquartered in West Long Branch, New Jersey, has been a pioneer in wireless CDMA ASICs which will support the new global roaming standard.

Richard C. Kirby, former director of the ITU for Radio Communications, said "It is encouraging to see the global consensus building foreseen by ITU's IMT 2000 process is already getting under way among business and standards activities among Europe, Asia and the US".

Optus opens new Brisbane-Sydney cable

Optus Communications has opened a second major fibre-optic cable between Sydney and Brisbane, to cater for an expected 1000% growth in demand for capacity. The 1300km cable cost more than $30 million. It is expected to provide significant efficiency, customer benefits and cost savings to Optus, of up to $45 million over 10 years.

The new route has established points of interconnect for Optus at Bathurst, Orange, Dubbo, Tamworth, Armidale and Toowoomba. Prime contractor for the project was Telstra Network Design and Construction.

The cable uses optical amplifiers which allowed Optus to deploy signal regeneration equipment supplied by Fujitsu, at distances of 150km instead of the previous 50km. Initial cable capacity is 2.4Gb/s, but this can be upgraded to 10Gb/s.

TelePacific to sell tiny Canon camera

TelePacific, the Australian telecomms arm of Tech Pacific, has moved into data products distribution and has been appointed exclusive distributor for Canon Integrated Solutions' PowerShot 30T miniaturised digital camera.

The digital camera is now available from the TelePacific reseller base of large retailers, mass merchants and mobile data specialists. Retailing at $699, it is designed as a companion to a notebook computer. The camera is attached to a Type II PCMCIA card via a 30cm cable, and has a stand that allows it to be clipped into position at the top of a notebook screen. It can be used for anything from teleconferencing to creating business presentations, and operates as a videoconferencing camera via the Internet, public phone lines or local and wide area networks.

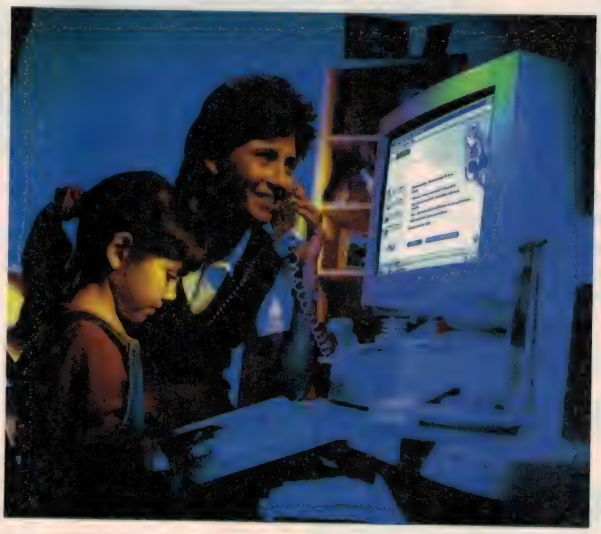
Intel creates online PC help

In the USA, Intel Corporation has set up a new service offering PC users friendly, easy and quick solutions to PC questions as well as a way to help protect their PCs against data loss and virus problems. Called Intel AnswerExpress Support Suite, the Internet-based service delivers comprehensive PC help, support and protection to home and small business users.

"With Intel AnswerExpress Support Suite, PC users get one-stop access to live help and automated, on-line support from a company known for quality", said James B. Johnson, VP of Intel Small Business and Networking Group and GM of its Internet Services Operation. "The service's user-friendly support and data protection technologies will help PC users resolve many of the technical challenges that can slow them down."

Subscribers receive:

- Ask Intel: Users submit PC-related questions via the Internet to a live specialist, who calls back in minutes — no more waiting on hold.
- Virus Protection: The suite detects and removes viruses from the PC; automatic online virus-pattern updates help guard against the latest known threats.
- Answer Library: Users can find time-saving tips, tutorials, answers and articles at their fingertips from leading PC industry sources like Ziff-Davis, PC World Online and KnowledgeBroker, Inc..
- Online Data Backup: Users can help prevent the loss of important data files by keeping confidential backup copies off site at Intel's data centres. Files are retrieved quickly and easily.



Biggest QLD exhibition

Electrical engineering products firm NHP is holding a major electrical exhibition in Brisbane during July this year. The exhibition, called Global Tech 98, will be held at the Brisbane Convention and Exhibition Centre, and NHP claims it will be the largest electrical exhibition ever held in Queensland by a single supplier. The product displays will cover more than 100 square metres of floor area and will include many application-based working models.

The exhibition will be an excellent opportunity to view the entire range of NHP products in one location and to preview products soon to be released. In addition a series of technical papers will be presented by international and local speakers, covering a wide range of interesting topics including motor starting and protection, programmable logic controllers, variable frequency drives, circuit breakers, application smart metering and two-wire control systems.

The exhibition will open with a special preview on July 14, and then Global Tech 98 will run for two days, from July 15 to 16. For free registration, call NHP's Brisbane office on (07) 3891 6008.

Workshop on data communications

Instrument Data Communications (IDC) is again offering its Workshop covering the essentials of Data Communications for Instrumentation and Control, due to popular demand. To date, thousands of engineers, technicians and scientists worldwide have attended these workshops with excellent reviews.

The Workshop is aimed at providing engineers, scientists and technicians working in the instrumentation and control environment with the knowledge and skills to successfully work with data communications technology. It has been structured to cover the main concepts of data communications, to clarify their meaning and to evaluate their application in modern process control systems.

The Workshop uses an interactive and hands-on style to enhance the learning process. All information has also been carefully structured and reviewed by independent experts in the field. A comprehensive manual of over 400 pages provides an excellent reference for course delegates at the conclusion of the workshop.

The Workshop will be held in Malbourne on 1-2 June and in Perth on 4-5 June. For more information contact Samantha Sharpe on (02) 9955 2706.

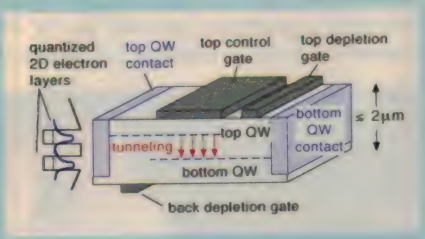
Quantum tunnelling transistor breakthrough

A new quantum mechanical transistor created by scientists at Sandia National Laboratories in Albuquerque, New Mexico is capable of switching at speeds of up to one terahertz (10^{12}Hz), and could be the breakthrough that will allow dramatically faster computers. The device takes advantage of electrons 'tunnelling' through a potential barrier that, according to classical physics, is impenetrable.

"We have demonstrated real circuits that work and are easily fabricated", says Jerry Simmons, leader of the Sandia development team. "It is not ready to be sold yet, but it is a significant advance."

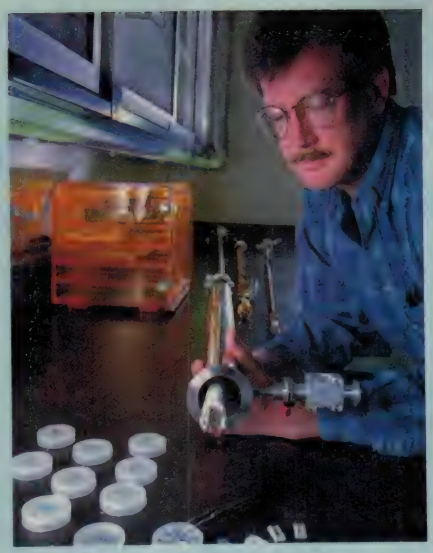
The device, dubbed DELTT (Double Electron Layer Tunnelling Transistor), offers promise of significant improvements in the speed of computers and in the accuracy of sensors. Sandia is a laboratory of the US Department of Energy (DOE).

The device may run at a trillion operations a second, as have other, more primitive tunnelling devices. This is roughly 10 times the speed of the fastest transistor circuits currently in use. The actual speed has not yet been measured, says Simmons, because it is "not easy to measure such high speeds,



which are near the limits of what can be measured with conventional equipment." The extremely fast device also runs at extremely low power — tens of millivolts and microamps — as compared with the few volts and milliamps needed by transistors currently in use.

Actual use of the transistor by industry may be years in the future because of other engineering problems to be tackled. These include questions of temperature — the device now works only at temperatures at or below 77K, though rapid improvement, using existing technology, indicates it should be operating at room temperature by next year, says Simmons.



Another problem involves designing millions of such circuits on a chip, as is currently done with ordinary transistors. Because of the Sandia device's multifunctionality — it has three positions, off-on-off, instead of the normal transistors' two on-or-off states — the same amount of work can be performed with significantly fewer transistors, but chips would have to be completely redesigned.

The device relies in part upon the dual wave-particle nature of matter. Two gallium arsenide layers, each only 150 angstroms thick, are separated by a 125 angstrom aluminum-gallium-arsenide barrier. Ordinarily, gallium arsenide electrons in one layer do not have the energy to reach the other layer. But the extremely thin barrier allows the electrons to behave like waves, which can poke into the barrier.

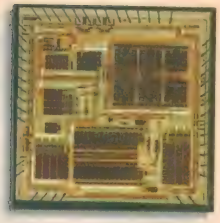
When an electron is adjusted to have the same energy and momentum states in both regions — something that can be done by applying a voltage to these regions — it can pass from one region to the other without any scattering, as occurs in normal electron motion due to crystal imperfections. In effect, they tunnel under the barrier.

Previous attempts at building tunneling transistors had been made by researchers who created layers side by side on a surface. This proved too difficult a task for current technology to manufacture accurately at 1000 angstroms or the even smaller dimensions necessary. ❖

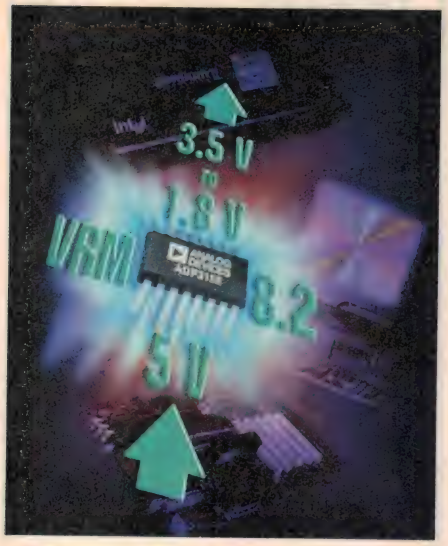
NEWS BRIEFS

- Melbourne-based hifi distributor ***Scan Audio*** has appointed Mike Wilson as National Sales Manager. Mr Wilson is located at the company's NSW office, in Thornleigh.
- Boundary-scan testing and programming specialist JTAG Technologies has appointed ***ProDigital***, of Kings Langley in NSW, as its exclusive distributor for Australia and New Zealand.
- ***NEPCON AUSTRALIA '98***, which marks the inauguration in Australia of the international NEPCON series of exhibitions, will be held at Sydney's Darling Harbour Exhibition Centre from May 26-28 — adjacent to the complementary AIEE'98 international engineering exhibition, being held at the same time. ❖

Solid State Update



Keeping you informed on the latest developments in semiconductor technology



Switching regulators optimised for Pentium II

The new Analog Devices ADP3152 and ADP3153 synchronous switching regulator controllers are optimised for Pentium II processor applications where 5V is stepped down to a digitally controlled output voltage between 1.8V and 3.5V, to provide power for the Pentium core. It is claimed as the first switching regulator to include an integrated, on-chip crowbar function to assure overvoltage protection of the Pentium II processor if the high-side FET of the switcher fails to short.

The novel compensation scheme used in the devices is said to assure optimum load transient response. With a footprint up to 50% smaller than discrete designs, the ADP3152 and ADP3153 reduce the bill of materials cost for VRM 8.2-compliant, Pentium II motherboards.

Using a five-bit DAC to translate a voltage identification (VID) digital code directly from the CPU, the ADP3152/3 use a current mode constant off-time architecture to generate the precise output voltage. The devices drive two synchronous N-channel MOSFETs, capable of delivering up to 15A load current for Pentium II processors, at a switching frequency of 250kHz.

The ADP3153 includes an on-chip LDO controller, which can be used to provide power to the I/O buses on the motherboard. Both devices meet all the power requirements of the Pentium II processor as well as Intel's VRM 8.2 specifications with better than 90% efficiency and an initial output accuracy of+/-1.5%.

For more information circle **271** on the reader service card or contact Analog Devices, PO Box 2098, Rosebud Plaza 3939.

Low distortion quad FET input op-amp

Burr-Brown's new SoundPLUS OPA4134 is an ultra-low distortion, low noise operational amplifier that completes the company's family of previously introduced single and dual audio op amps — the OPA134 (single) and the OPA2134 (dual). The OPA4134's true FET-input stage provides the superior sound quality and high speed needed in professional and high-end audio systems such as recording studio equipment (mixing boards, effects processors), radio/television equipment (broadcast consoles, compressors/limiters), and multimedia equipment.

The OPA4134 uses a fully cascoded input stage, ensuring that input bias current remains virtually unchanged throughout the full common-mode range, minimising distortion. High output drive capability, wide output voltage swing (within 1V of the rails), and excellent DC performance enhance its exceptional audio performance.

The device is unity-gain stable and provides outstanding dynamic behavior over a wide range of load conditions, including high load capacitance. In addition, it is free from phase inversion and overload problems commonly found in FET input op-amps. Key specifications include 0.00008% THD, 8MHz gain bandwidth, 20V/us slew rate and 8nV/√(Hz) voltage noise.

For more information circle **272** on the reader service card or contact Kenelec at 2 Apollo Court, Blackburn 3130.

SO-8 power MOSFETs save more energy

Three new LITTLE FOOT SO-8 power MOSFETs specifically intended for DC-DC conversion circuits in notebook computers have been announced by TEMIC Semiconductor member Siliconix. Built on Siliconix' proprietary 32 million-cell TrenchFET technology, the new devices allow designers to obtain more efficient use of battery power without any increase in component count.

The new Si4416DY has been optimised for notebook computer power conversion applications with faster switching speeds, lower gate charge, and the lowest on-resistance ever achieved in a PWM- optimized device. Turn-off times are more than twice as fast (32ns) as the standard device typically used in these applications, while gate charge has

been reduced by a third, to 24nC. On-resistance is a low 18mΩ at a 10V gate drive.

The new Si4806DY (N-channel) and Si4807DY (P-channel) are claimed as the industry's first MOSFETs with two gate connections, to maximize the efficiency of DC-DC converters that operate with two distinct load levels. When the computer is operating in full-power mode, both gates are driven together to provide a maximum current rating of +/-7.7A. In light-load conditions, only the second gate (which controls a small part of the MOSFET) is driven, providing a maximum of +/-2A of current. The availability of both N-channel and P-channel versions supports several DC-DC converter topologies, including synchronous mode.

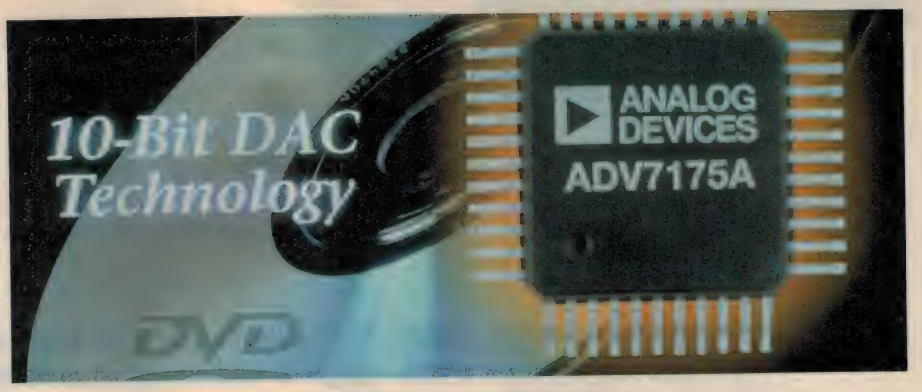
For more information circle **274** on the reader service card or contact distributors Braemac or Avnet VSI Electronics.

24-bit 96kHz DAC for audio apps

The SoundPlus PCM1716 from Burr-Brown is a high performance 24-bit, 96kHz delta-sigma digital-to-analog converter (DAC) designed for mid to high grade digital audio applications, which achieve 96kHz sampling rates with 24-bit audio data. The PCM1716 is said to offer the industry's best price/performance ratio of any high performance audio DAC, with a dynamic range of 106dB and a THD+N figure of -96dB.

The device features a newly developed 'enhanced multi-level delta-sigma modulator' that improves audio dynamic performance and reduces jitter sensitivity. An internal digital filter operates at 8x oversampling at a 96kHz sampling rate, with two selectable roll-off performances: sharp roll-off and slow roll-off. Special functions include digital de-emphasis, left and right independent digital attenuation, soft mute, zero detect mute, zero flag, and reversible output phase.

PCM1716 accepts 16/20/24-bit input data and can be used with a variety of audio clocks. In addition, it processes 24 bits internally and has single ended analog outputs, thus reducing the external components required in an audio system. For more information circle **275** on the reader service card or contact Kenelec at 2 Apollo Court, Blackburn 3130.



Low cost 10-bit NTSC/PAL encoders

Analog Devices has introduced two new video encoders that are priced at consumer video levels but are claimed to provide professional quality performance. The ADV7175A and ADV7176A are intended for DVD players, TV-output in DVD-equipped PCs, PC multimedia video editing systems, digital set-top boxes, digital still cameras and video phones as well as professional studio and broadcast video systems. The new encoders are fully compliant with digital video industry standards including ITU-R BT601/656 and SMPTE 170M.

Using 10-bit DACs in combination with a colour subcarrier generator based on a user-programmable 32-bit direct digital synthesizer (DDS), these video encoders provide more than 80dB of video signal-to-noise ratio and differential gain and phase of 0.4% and 0.4°, respectively. Designed to operate from either 3V or 5V supplies, the ADV7175A and ADV7176A can drive the full 35mA video-level signal, from all four DACs, into unbuffered, double-terminated, 75Ω loads.

Both encoders convert digital YCrCb (4:2:2) 8- or 16-bit component video data inputs into standard analog composite TV signals that are compatible with all international NTSC and PAL standards. In addition they can also produce S-Video (Y/C), YUV (YPrPb) and RGB (EuroSCART) video outputs. Multiple combinations of these are available simultaneously. Other programmable video functions include digital video filter adjustment, luma delay control, and colour and burst on/off control.

For more information circle **276** on the reader service card or contact Analog Devices, PO Box 2098, Rosebud Plaza 3939.

Fastest 8-bit RISC Flash micro

Atmel Corporation has expanded its offering of Flash microcontrollers with the introduction of what's claimed as the world's fastest and most powerful 8-bit device, the AT90S8515.

The new devices offer speed/power characteristics up to 10 times better than the performance ratings previously available from other 8-bit microcontrollers. Atmel says the performance advantage is the result of a new architecture that includes 32 eight-bit general purpose working registers, all of which are connected internally to the device's arithmetic logic unit.

The AT90S8515 has a performance approaching 8 MIPS at 8MHz. It is able to retrieve and execute an instruction in a single clock access cycle, which is three to twenty times faster than any 8-bit microcontroller on the market today. The device operates from 2.7 volts to 6.0 volts and has low power modes that brings the power consumption to below 1uA.

The AT90S8515 has 8KB of on-board flash memory, which is reprogrammable within the system without the need for any special voltages. It also has 512 bytes of on-board EEPROM, 512 bytes of on-chip RAM and a full range of integrated peripheral modules including a full duplex UART, high-speed SPI for serial communications and full featured timers/counters with compare, capture and pulse width modulation (PWM) modes.

A full suite of development tools is currently in stock.

For further information circle **273** on the reader service card or contact GEC Electronics Division, Unit 1, 38 South Street, Rydalmere 2116. ❖

Product REVIEW

Neutrik A2 audio test set

Despite its relatively simple front panel layout and small size, the Neutrik A2 automated test set can perform a wide range of audio-related measurements using its microprocessor-controlled, high performance signal analyser and generator. The results are displayed on a front-panel LCD and can be saved for analysis or printing at a later date, making this quite sophisticated instrument suitable for both field and bench audio testing.

by ROB EVANS

It's safe to say that audio test sets are a fairly specialised breed of test equipment, and in their earlier or low-cost form, often quite cranky beasts to drive. For example, the distortion meter facility of the simpler types is generally based on a narrow-band notch filter, which must be manually tuned to the test tone frequency. Thanks to the inevitable frequency drift in both the notch and oscillator circuits, the operator must continuously retune the notch while taking a distortion reading.

With this type instrument, making the usual range of performance measurements on a piece of audio gear can be quite a long-winded process, and usually involves some fairly intense knob twiddling. More elaborate (and expensive) types of audio test sets neatly solve the problem by including an elaborate auto-tracking circuit in the notch filter tuning part of the circuit, so that the notch frequency stays locked to that of the test oscillator.

These semi-automatic instruments are certainly easier to drive, but not surprisingly, they're much larger and more costly that the simple types. Other typical measurements such as signal-to-noise ratio, channel crosstalk and signal level can also completed in a semi-automatic fashion, making these instruments quite competent for the job but still fairly tricky to drive.

Not surprisingly then, the very latest breed of test sets have harnessed the power of a microprocessor to both automate and optimise the various test procedures, in an attempt to make the instruments more accessible and faster to use. As is the case with many other types of instruments this process has been very successful, allowing the device to be used by relatively inexperienced operators to make rapid measurements — quite a boon for quality control testing setups, for example.

Never underestimate a pretty face: Neutrik's A2 audio test uses a nicely laid out and intuitive front panel setup to control its very sophisticated internals.

State of the art?

Neutrik's A2-series Audio Measurement System appears to epitomise this automated micro-controlled test instrument philosophy, where the designers really haven't compromised in their quest for a versatile, high-performance but functional instrument. As a result, it uses the latest digital signal processing (DSP) techniques, high-resolution A/D converters, high-speed CPU-driven analysis routines, and just about any other leading-edge digital technology that comes to mind...

All of this operates under the control of the A2's central processor of course, so the user really isn't aware of the elaborate number-crunching going on behind the scenes. Even the front panel controls communicate directly with the CPU in a 'fly-by-wire'

fashion (in aviation buzz-word terms), so in effect, the operator's adjustments and settings are just interpreted and processed along with all other data.

In the practical sense though, the Neutrik A2 is clearly a very capable instrument, and can make measurements of signal level (relative and absolute), crosstalk, phase, frequency, total harmonic distortion (THD), intermodulation distortion (IMD), noise (absolute and relative S/N), plus wow and flutter (for tape-based systems). It's a true two-channel system by the way, so *relative* signal measurements such as phase shift are quite legitimate, as well as accurate.

As far as reading the test data goes, the A2 is equipped with a backlit 256 x 128 dot liquid crystal display (LCD), which shows straight numeric measurements in a large-text format (with bar-graph), while response curve traces (the result of swept-frequency

tests) are displayed as a full graphics image with additional text data. Also, signal data for *both* input channels is displayed when appropriate, plus response curves can be overlaid on the screen (for immediate comparisons) and/or saved for later analysis.

The display in fact has three distinct operating modes, which can be used during any of the instrument's measurement tests. These are 'meter' (straight numbers plus bar-graph), 'graph' (graphic curve traces), and 'scope' (pseudo-oscilloscope view of the relevant signals). The latter option will show both input channel signals during a level or phase test, the input and actual distortion artifacts during THD and IMD tests (very handy indeed), and much more.

Other than that, the A2 offers fully balanced (and floating, if necessary) input/outputs, several standard audio filter characteristics (including those for weighted measurements), a built-in monitor speaker, a DB-25 printer output socket, a fully programmable signal generator (sweeping function and waveshape), selectable input and output resistance, and as you'd expect, automatic 'intelligent' gain and range scaling.

All in all, its pretty impressive stuff, and must surely qualify the Neutrik A2 as a state-of-the-art instrument at the leading edge of automated test set development. As you can see from the shots of the actual unit, it's a deceptively simple-looking instrument housed in a relatively small package. With overall dimensions of 274 x 396 x 132mm plus a weight of around 9kg, the A2 definitely deserves the 'portable' tag — it's just that it has the capabilities you'd expect from a large and complicated bench-top audio test set.

Testing the tester

As usual when trying out an instrument with a reportedly 'friendly' user interface, we powered the unit up and jumped in at the deep end by attempting to make several 'typical' measurements with the A2, *without* referring to the manual in any way. The fact that we were able to smoothly complete these tests in a short time showed the worth of the operator interface Neutrik has built into the A2.

When measuring the THD content of a signal for example, it was just a matter of connecting the device under test (DUT) and pressing the A2's THD button in the 'measurement function' group, with (say) the 'meter' display mode selected. The readout showed the signal's THD in percent, as you'd expect, while selecting the 'scope' screen mode displayed the signal itself, plus the residual distortion components — by winding up the monitor volume, you could also *hear* those artifacts.

Note that during this process the A2 automatically selected its optimum input range scaling, set the distortion reference level, tuned the analysing circuit (effectively, the traditional notch filter), and adjusted the display range of the THD readout. The important point here is that these adjustments had to be completed manually with audio test sets of the past, whereas with instruments like the A2, you just press the THD button when you want to measure THD — and that's pretty much it...

Overall, the A2's buttons and (alpha-type) rotary controls seem to be laid out (and work) in quite an intuitive way, and as promised make the unit quite straightforward to drive. The only time we needed to refer to the supplied manual was when things became a little sticky during some of the more involved tests and display functions.

Somewhat ironically though, we then found that the manual was rather less intuitive than the unit itself, due to the fairly cumbersome language structure used in its text. While it's certainly well laid out and informative, we suspect that the text lucidity has suffered during the (presumably) German to English translation — we found ourselves reading many sentences several times before the concept got through.

That minor quibble aside though, we found the Neutrik A2 to be a very impressive piece of gear. It's resolution comfortably bettered our — comparatively large and cumbersome — in-house audio test set, and as a bonus it was much faster and simpler to use.

By the way, besides all of the features mention above the A2 can be fitted with a huge array of retro-fit options ranging from IEEE-488 interface cards (for remote control/access) through to plug-in FFT modules (for spectrum analysis). In fact, the supplied review unit was the upgraded *digital* and analog version of the A2, the A2-D — unfortunately though, we really don't have the equipment here at *EA* to put the digital audio section through its paces.

So with the Neutrik A2 being such a terrific piece of gear, perhaps we should all have one around the workshop for when a spot of audio testing is needed. Nice as that would be, you'll need fairly deep pockets to cope with its price tag of $10,671.13 (including tax), or $13,591.15 for the digital version reviewed here — don't forget the 15 cents!

By the same token however, the A2 appears to be a very competitively-priced *professional* automated audio test set, and its high-tech but flexible design must put it at the front of the pack. ❖

Neutrik A2/A2-D

A fully-automated portable audio measurement system with a LCD display and a 'user-friendly' operator interface. Supplied with protective front cover, power cord, calibration certificate and a substantial users manual.

Good points: *Very high performance, automated operation — making it easy and fast to use.*

Bad points: *User manual is fairly tough going.*

RRP: *A2, $10,671.13; A2-D (with digital audio options), $13,591.15 — both including tax.*

Available: *Amber Technology, PO Box 942, Brookvale, NSW 2100; Phone (02) 9975 1211, or fax on (02) 9975 1368.*

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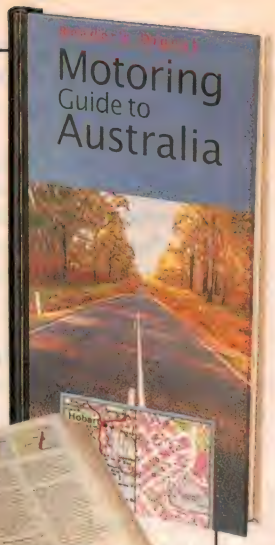

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New Products

CD labeller

CD Stomper Pro is claimed as a complete solution for custom labelling of compact discs. It facilitates the three main elements of CD labelling: design, print and application.

CD Stomper Pro includes Design Studio label design software, which runs under Win95, NT, Win3.X and Mac. 1200 clip art images, 75 PhotoStock images and design templates for popular programs such as Word and CorelDraw are also included.

100 precut adhesive labels (100 for CD, 200 for Jaz/Zip/3.5" floppy) are included along with 20 jewel case inserts sets, all on A4 stock. The label stationery is a symmetrical design which will print correctly no matter which way it is fed into the printer. Additional labels and inserts are available separately.

The CD Stomper Pro CD label applicator is a simple to use, one-piece design that perfectly aligns a label onto the CD surface.

Suggested list price for the CD Stomper Pro is $99.95 including sales tax.

For more information circle **242** on the reader service card or contact BJE Enterprises, 124 Rowe Street, Eastwood 2122.

Rubidium frequency standards

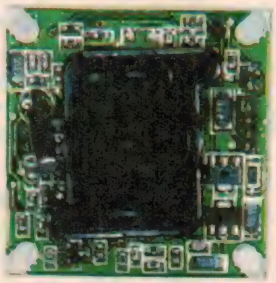
Novatech Instruments has released three new versions of its 2950AR Rubidium Frequency Standard. Dubbed the 2950AR/01, /02 and /03, these versions provide additional output frequency combinations while maintaining the +/-5 x 10^{-11} monthly stability of the 2950AR. The 2950AR/01 provides three 10MHz outputs; the 2950AR/02 provides 10MHz, 5MHz and 100kHz; while the 2950AR/03 provides three outputs of any customer-specified combination of 10MHz, 5MHz, 1MHz and 100kHz.

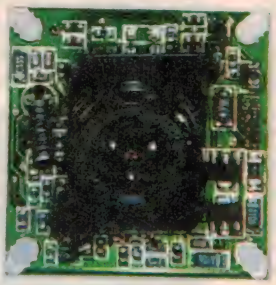
The 2950AR/01 is US$4145, the 2950AR/02 is US$4245 and the 2950AR/03 is US$4495. Delivery is stock to eight weeks, ARO.

For more information circle **244** on the reader service card or contact Novatech Instruments, 17962 Midvale Avenue North, Suite 219, Seattle WA 98133, USA.

Tiny CCD camera

Allthings Sales & Services is now supplying two tiny CCD Video Camera modules, complete with lens on a printed circuit board. The cameras employ a low-noise, high-resolution Sony silicon CCD sensor together with supporting Sony chip set.





The cameras require only a 12V DC regulated supply and may be connected directly to the composite video (AV) input on a VCR, TV, video monitor, PC video capture card, TV modulator, video transmitter, etc. They are fitted with either a 3.6mm board or 5.5mm pinhole lens. Dimensions are 32 x 32 mm with a depth of either 15mm or 27mm depending on lens, and a weight 12 - 16 grams.

Horizontal resolution is 400-plus lines, so they produce S-VHS quality images. Sensitivity is 0.05 lux, ideal for low light applications. This high sensitivity combined with a spectral response reaching up to over 950nm ensures excellent results when used with IR (infrared) illuminators for discreet or covert surveillance. Other specifications are 1/50 to 1/100,000 second linear automatic electronic shutter, 48dB+ signal/noise ratio and automatic gain control. Power requirements are 12V DC at 110mA and output is standard CCIR 75Ω composite video.

The cameras are priced at a very competitive $99. For more information circle **243** on the reader service card or contact Allthings Sales & Services, phone (08) 9349 9413 or fax (08) 9344 5905.

CFC-free freezer

Richard Foot has announced the release of a new RF Freezer Spray using a 'brilliant formulation' with safe non-CFC propellant. The product is non corrosive and non flammable, and is suitable for a number of specialist applications.

These include rapid cooling of electronic components to detect thermal faults; shrink fitting of mechanical assemblies; testing and repair of thermal sensitive devices; and histology/anthology.

The product is inexpensive and allows mobile technicians to freeze jobs on the spot.

For more information circle **248** on the reader service card or contact Richard Foot, 14/2 Apollo Street, Warriewood 2102.

Three-phase filters

The new Schaffner FN 256 series of radio interference filters are provided with LCR filtering in all legs including the neutral connection, making them ideal for assymetrical loads. Typical applications range from scientific and medical electronics to industrial control systems including motor control centres, and any equip-

ment with phase unbalanced electrical loads. Nominal balance (at fundamental or power line frequency) does not necessarily mean that the harmonic content per phase is balanced, of course.

The FN 256 filter family are characterised by a small footprint (153 x 140mm) and low weight due to the use of a special potting compound. They are available in standard voltage rating of 440V (line), and with phase current ranges selectable from 8 - 64A.

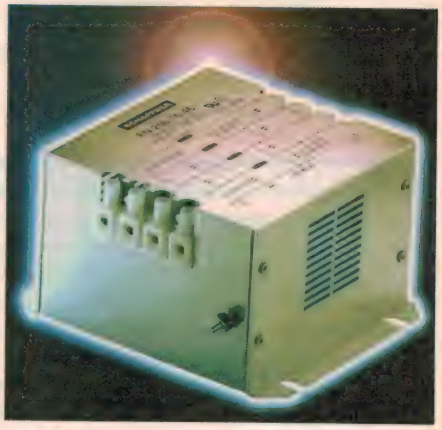
For more information circle **245** on the reader service card or contact Westek Industrial Products, Unit 2, 6-10 Maria Street, Laverton North 3026.

3.2GHz calibrator for scopes

Wavetek's new Model 9500/3200 Scope Cal Workstation incorporates the company's Active Head Technology and allows the bandwidth of high performance oscilloscopes to be calibrated right up to 3.2GHz. The instrument provides a single-box solution which eliminates the need for additional equipment such as RF signal generators, tunnel diode pulsers and signal multiplexers in the calibration setup, making HF scope calibration easier and faster and also improving its traceability to National Standards. It also allows the calibration process to be fully automated.

Crucial to the unit's ability to deliver 3.2GHz levelled sinewaves, with an AC flatness (relative to 50kHz) of better than +5% (+/-0.45dB) was the development of a brand new Active Head for the workstation's mainframe calibrator. Designated the Model 9530, this new Active Head senses the amplitude of the sinewave within millimetres of the oscilloscope input and delivers it via an accurately matched 50Ω transmission path. It also includes UHF precision attenuator networks that enable the user to adjust the output over a dynamic range of 4.44mV to 2.22V, allowing all the critical input ranges of an oscilloscope to be accurately calibrated.

New Products



The performance is made even more impressive by the fact that the same Active Head also delivers all the other waveforms required for oscilloscope calibration — including 150ps rise and fall time return-to-ground edge waveforms for pulse response bandwidth testing.

For more information circle **241** on the reader service card or contact Scientific Devices Australia, 118 Atkinson Street, Oakleigh 3166.

Lower cost spectrum analyser

Advantest has announced a new budget priced spectrum analyser Model R3131, which has a wide range of application in the communications, TV, consumer electronics and EMC fields.

The R3131 operates in the frequency range 9kHz to 3GHz, with a noise floor of -113dBm at 1kHz resolution bandwidth. The upper frequency of 3GHz allows measurements in modern communications systems such as DCS, PCS, DECT, PHS, W-LAN and digital satellite receiving systems.

The R3131 monitor has a 100dB logarithmic display range, allowing the display of large signal level differences. The waveform refresh rate is 100ms and changes during alignments can be displayed in quasi-analog form.

Other features include a comprehensive soft-key menu system and a built-in counter with 1Hz resolution, power measurements which include adjacent channel, occupied bandwidths, average and total power within a selected frequency window. The unit has an inbuilt MS-DOS compatible disk drive which can store instrument settings and waveforms which can be integrated into Windows applications.

For more information circle **246** on the reader service card or contact Rohde & Schwarz (Australia), PO Box 6105, Silverwater 2128.

New NI catalog

National Instruments — the 'Virtual Instrumentation' Company — has announced its new, full-colour 1998 Instrumentation Catalog. The free, 864-page catalog details more than 600 software and hardware products that engineers and scientists use to develop integrated, computer-based systems for measurement and automation applications. It includes tutorials on data acquisition, GPIB, VXI, and industrial communications; product line overviews; and selection guides — all designed to help readers increase productivity and save money with virtual instrumentation.

New product highlights include PXI modular instrumentation; Fieldpoint distributed I/O, computer-based instruments, and a new line of motion control products. The 1998 catalogue also describes new versions of LabVIEW, LabWindowsTM/CVI, HiQ, Lookout and BridgeView application software products, as well as numerous new data acquisition products.

For more information circle **249** on the reader service card or contact National Instruments Australia, PO Box 466, Ringwood 3134.

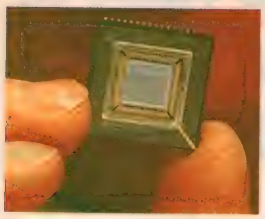
5W UHF transceiver

Imark Communications has released the Pantech PS-410CW, a 99-channel 5W portable transceiver for operation in the Australian UHF band from 450 - 480MHz as well as in the UHF CB band.

The Pantech PS-410CW Series are compact, ruggedly constructed state of the art portable transceivers. They feature a high selectivity front end that provides a switching bandwidth of 10MHz on the UHF high-band. Two RF power outputs of 1W or 5W are selectable on the top panel.

The transceiver is supplied with both multi-tone Digital Coded Squelch and multi-tone CTCSS Encoder/Decoder, which are selectable on a per-channel basis as standard equipment. Features such as Transmit Time-out Timer, Time-out Timer Penalty, Busy Channel Lockout, Delayed TX, Low Battery Alarm, and Battery Saver Circuit are all standard inclusions. The PS-410CW also includes a Voice Storage facility that allows the user to record 'off air' up to 20 seconds of message. This facility is ideal for couriers, delivery, maintenance, and service personnel as it allows them to record the next job instructions or address.

For more information circle **247** on the reader service card or contact Imark Communications, 75 Mark Street, North Melbourne 3051. ❖



Silicon Valley Newsletter

Breakthrough could bring 0.08um chips

A TEAM OF GRADUATE STUDENTS at the University of Texas, in cooperation with researchers from DuPont Photomasks and funding from the SEMATECH chip research consortium, say they have developed a revolutionary semiconductor production technology that will enable chipmakers to produce circuits with features as small as 0.08 micron. That's about four times smaller than current state-of-the-art 0.3um technology.

The development involves the process of creating the photomasks that contain the circuit patterns for each layer in the chip-building process. The most advanced microprocessors today use as many as 800 different masks to build a single chip. The problem the industry is facing is that it has become increasingly difficult to use conventional optical light sources to create a sharp, focused image of the ever-smaller chip features.

The development by the Texas researchers was especially impressive, because they were able to print the 0.08um circuit patterns using an ultraviolet light source with a wavelength of 193nm, or about 0.2um. Most research for sub-0.25um production today is focused on using 'extreme ultraviolet' light at 13nm.

Based on the best estimates prior to the Texas breakthrough, the earliest anyone had expected 0.08um devices to be built was by around 2008. If the new process can be commercialised, the technology could be available for commercial use as early as 2003.

Hi-tech industry seeks more imports

US HIGH-TECH COMPANIES are scrambling for software and electronics engineers, and as many as 340,000 highly skilled jobs in the computer and electronics industries are currently unfilled. Increasingly, US companies are looking in other countries to recruit them. But a section of US immigration law severely restricts the number of foreign skilled workers that US companies can bring in.

Years of apathy among American college students towards the high-tech field, combined with a high-tech industry that has been booming for nearly seven straight years, has created the acute shortage in the pool of new technical talent from which the industry can draw.

Lobbyists for the high-tech industry companies and trade groups went to Washington in late February to lobby the powerful US Judiciary Committee, which oversees immigration reform, for permission to hire more foreign professionals. "The entire industry's continued growth and success is threatened by a severe and very real skills shortage", Microsoft's VP for human resources, Michael Murray, told the Senate Judiciary Committee.

Murray, along with executives from Cypress Semiconductor, Texas Instruments and Sun Microsystems also testified about their problems attracting qualified engineers and asked the committee to support a proposal to eliminate the 65,000 cap on hiring foreigners set by the Federal Government.

Despite the high starting pay engineers fresh out of college can obtain today, the level of interest in math and sciences has not increased significantly across US campuses, where students remain more interested in business-related studies. Part of the problem is that US high schools are turning out ill-prepared students in ever greater numbers. A recent study ranked US high school seniors near the very bottom in math and science skills among their peers in 21 industrialised nations.

IBM claims this new Travelstar 6GT is the highest capacity slimline 2.5" hard disk drive yet announced. Designed for notebook computers, it's only 12.5mm high yet stores an impressive 6.4GB. It's the first notebook HDD to feature IBM's breakthrough GMR head technology.

FTC puts hold on Digital-Compaq merger

THE US$9.6 BILLION acquisition of Digital Equipment by Compaq Computer has been put on hold, as the Federal Trade Commission notified executives for both parties it wants more information from Compaq before giving its OK to the merger — the largest in computer industry history.

The information request may indicate the FTC is considering the impact of the merger on competition in certain markets, including microprocessors. Compaq, which is strongly committed to the Intel-based PC processor architecture, will inherit the Digital Alpha chip which competes with Intel in the market for PC-based high-end workstations and servers. Conceivably, Compaq could kill the Alpha line in favour of more cost-effective Intel processors. If that is the finding of the FTC, the commission could force Compaq to divest the Alpha group or other parts of Digital's business as a condition of the merger.

At Compaq's headquarters in Houston, attorney Stephanie Lucie said the FTC request did not necessarily suggest the firm may have to divest some operations to address regulators' anti-trust concerns. "Our reading of the request is that that will not be necessary. We're not surprised that we received the request."

TI drops out of DRAM partnership

IN THE CLEAREST indication yet that Texas Instruments may be trying to get out of the DRAM memory market, the Dallas based chipmaker is ending a nine-year DRAM partnership with Taiwan's Acer and will sell its interest in the joint DRAM venture to Acer. Weeks earlier TI also ended a US$500 million DRAM program (Twinstar Semiconductor) with Japan's Hitachi.

Founded in 1989, TI-Acer will be renamed Acer Semiconductor

Manufacturing Inc. TI has held a 33% stake in the company.

The latest move all but confirms a new TI product and marketing strategy, away from DRAM chip volatility and emphasizing more stable and profitable logic circuits such as digital signal processors. DRAM prices have been at depressed levels for more than two years and no end is yet in sight for the glut of production capacity. And PC demand is slackening off, so DRAM prices may come under even more pressure in the months ahead.

Acer chairman Stan Shih said Acer would fully integrate its IC design, manufacturing, marketing, testing and packaging capabilities to form a new full-scale semiconductor business, including DRAMs and other circuits. Under the terms of the deal, TI will transfer the latest DRAM technology to the new company for the next 10 years. TI has also committed to purchasing all DRAM produced by the new firm for a year.

PCs in nearly 50% of US households

THE LEVEL OF PENETRATION of personal computers in the United States is rapidly approaching 50%, driven by the new generation of sub-$1000 computers, according to a new report from market research firm Computer Intelligence of La Jolla in Southern California.

PCs are now present in 45% of American homes, up from 40.2% a year ago. In the higher income area (US$100,000/year or more) the penetration is now 80%. Even in the low-income market of families with annual incomes of less than US$30,000, the penetration is still around 25%.

"I expect penetration to continue to climb and surpass 50% by the year 2000", said David Tremblay, senior analyst at Computer Intelligence. "Some have said that the consumer PC market is dead or dying; our market data shows that just isn't the case."

IBM to make AMD's K6 chip

IBM HAS AGREED to start manufacturing the K6 microprocessor from Advanced Micro Devices. The move is critical for AMD, which has been struggling to meet demand for its low-cost competitor for the Intel Pentium II.

Under the terms of the agreement IBM, which has been a major customer for the K6, will produce the AMD chip for the next two years. While the deal will help AMD in the long run, the short-term shortage of K6 processors will likely continue. IBM is not expected to get the K6 into volume production until late in the year.

For IBM the deal means a much needed replacement for the Cyrix processor line. IBM has been making most of Cyrix's PC processors, but National Semiconductor acquired Cyrix in 1997 and is readying its own production facilities to make Cyrix's chips.

Rather than using some or all of the K6 chips for its internal system production, IBM will merely function as a foundry operation for AMD — producing only the K6 wafers. AMD will continue to manage the assembly of the final product.

Adaptec buys Symbios from Hyundai

SYMBIOS LOGIC, the Fort Collins, Colorado-based chip manufacturing subsidiary of Korea's Hyundai Electronics has been sold to Adaptec, the Silicon Valley-based maker of computer I/O and network connection products for US$775 million. Symbios makes semiconductors and storage systems for personal computers, workstations and telecommunications equipment. The firm's customers include Compaq, Sun Microsystems and Apple Computer.

Hyundai's decision to sell the US subsidiary was prompted by its efforts to restructure the semiconductor operations and raise funds to pay for new plants and equipment. The two-year crisis in the DRAM memory market has caused Hyundai and other Korean chipmakers to lose large sums on their semiconductor operations, at a time when heavy investments are required to build the chip facilities for the next generations of memory chips.

Hyundai officials said they plan to use the proceeds from the Symbios sale to help finance a US$1.3 billion chip fab the company is building in Eugene, Oregon.

The sale means Symbios employees will have to answer to yet another parent company. For years, the group was known as NCR Microelectronics. After AT&T bought NCR in a hostile takeover battle in the early 1990s, the group was sold to Hyundai in 1995 for US$340 million and became Symbios Logic.

The company has 781 employees in R&D, assembly and testing in Fort Collins and 867 people in wafer fabrication and engineering in Colorado Springs. The unit produced a profit of US$68 million in 1997 on total sales of US$614 million.

Intel announces Celeron processor

THERE'S BEEN AN EXPLOSION of interest in the sub-US$1000 PC market, an area where Intel and other chip makers have been slow to establish a presence. However Intel has announced that it will start to address the needs of this market with a new line of processors called 'Celeron'.

The new chips will use the same Intel P6 architecture on which the Pentium II processor is based. They will be targeted at PCs costing between US$800 and $1200.

The first Celeron chip will run at 266MHz but will not include level two (L2) cache, which stores the information and the order in which the processor performs its executions — although later versions will. ❖

DVD encryption pact announced

INTEL AND SOME OF the world's most powerful consumer electronics companies have announced agreement on a new encryption industry standard that will prevent DVD-based movies and other digital content to be duplicated via the Internet.

"We have all agreed on a method that can be used to protect digitised content in a way that can be applied to both consumer electronics and computer products", said Jim Reilly a spokesperson for Matsushita Electronics, one of the electronics firms which, along with Hitachi, Sony, Matsushita and Toshiba are supporting the encryption proposal.

The move comes as welcome news for the entertainment industry, where sales of digitised versions of movies, music and television shows have been depressed as consumers have taken a wait-and-see attitude towards DVD, which has suffered from a lack of blockbuster titles. Several major studios have held out releasing their titles in forms that can be read by computers.

The entertainment industry estimates that losses from digital piracy already exceed US$2 billion dollars a year. Unlike previous analog material, with digital recordings pirates can more easily download a digital sound or video file on the Internet, copy and endlessly duplicate it without any degradation in quality.

Apple kills Newton

AFTER FOUR YEARS of struggling to create a market for its handheld personal digital assistants (PDAs), Apple Computer has given up on the Newton computer after failing to find a buyer for the unit. Apple said that eliminating the Newton will free it from a distraction and help focus development efforts on new operating software for the Macintosh computer line.

The Newton PDA was a product envisioned by former Apple chairman John Sculley. But the gizmo, the first hand-held device to recognise handwriting, never quite caught on with businesses and consumers.

The Newton did, however, inspire a new class of computing devices, some small enough to fit in a shirt pocket. In fact, sales of hand-held computers more than doubled to two million units last year, according to Dataquest in San Jose.

LINUX:

What it's ALL about

Recently, in discussing operating systems for PCs, *EA* columnist Tom Moffat mentioned Linux — the 'third' OS for IBM compatibles. Apart from noting that it was a version of the Unix OS used on many Internet servers, he didn't say much about it. But here's a quick introduction to Linux, which may help you understand why it's so popular with programmers.

by JOHN AUGUST

When he mentioned it recently in his column, Tom Moffat noted that there was considerable interest in the Linux operating system (OS), but admitted he was not too familar with it. So what *is* Linux — and why do so many people like myself swear by it?

Linux is essentially a free version of Unix. Unix is a commercial operating system which has been used on mainframe computers, and was originally developed by Bell Labs. Linux is free because it has been put together by numerous hackers over many years, as a labour of love. As such it's a wonderful thing.

Some of Linux's advantages are the same as that of Unix. Others are a consequence of it being free...

Linux gives you a lot more control, in terms of what you can type in at the cursor, than you ever had in DOS. You can very easily send the output of one program into another, and scan a file or directory for particular information.

Its syntax is different from DOS, and takes a bit of getting used to. Rather than **dir**, you use the command **ls** for a brief listing. If you want a more detailed listing, you use the command:

ls -l

If you want to divert the output of a directory listing, you use the command:

ls >file

If you want to search a group of files for some text, you use the command:

grep text files

Of course, some of this is shared by DOS. But much of what makes up the 'extended DOS' package is part of the basic Linux package. Linux also has a few helpful shortcuts. If you want to change directory, you don't have to type in the whole name — wildcards (that is *) can be used. And it's easier to move directories around and delete them.

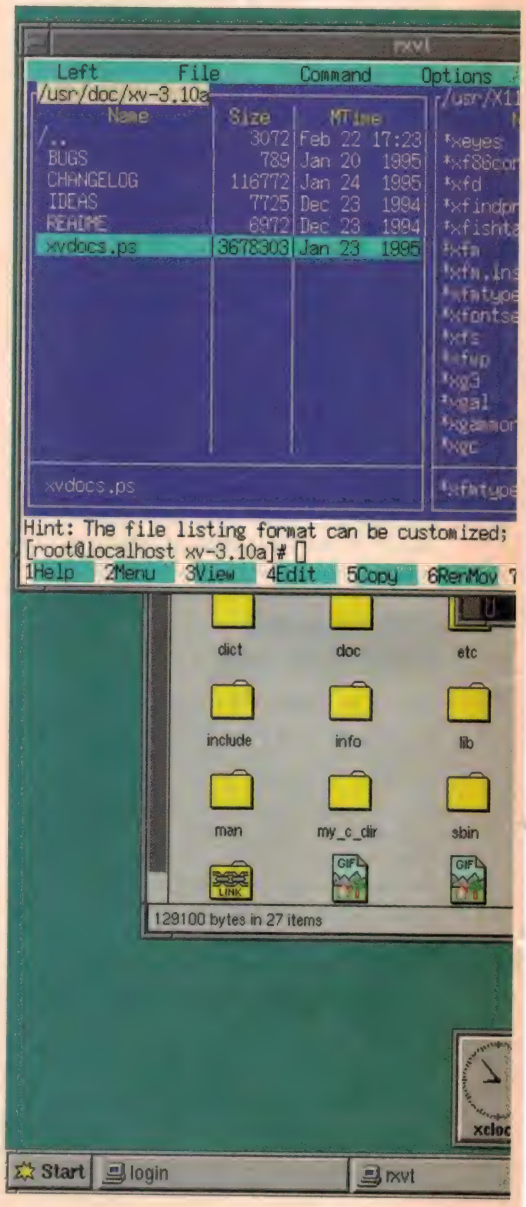
File names in Linux can be at least a line long. Together with wildcards, this encourages you to name your files with names long enough to be self explanatory.

Files in Linux have read, write and execute permissions for three different groups of user — the individual, the group and the public. These permissions are inherited from Unix, which ran as a multi-user system on mainframes. For some situations they are unnecessary, but they do make Linux more flexible, particularly when used in networks.

Compared with DOS, standard Linux gives you no warnings — it just does what you ask it to. If you give it a command to delete all directories, it will do just that. There are no 'are you sure?' type warnings. Poof! It's gone. It is a very different environment. (It is however possible to setup Linux so commands do give you 'warnings').

You can generate the equivalent of batch files in a 'script language' which is much more powerful than the DOS batch language. And if you want to make the equivalent of an .exe file, you just use the built-in compiler. No need to buy additional proprietary compilers. It's all there as part of the 'basic package'. If you want to process files, it is an easy thing to feed the input and output of scripts and executables (the equivalent of .exe) to files.

Linux was written to access directly the total memory addressing capability of the Intel processor. If you wanted to access memory above the basic 640KB in DOS, you had to jump through many hoops. But in Linux C, if you want a 5MB array, you just define it and it's done. (It does help if you have the memory there, of course!)



A sample screen dump from a PC running Linux, showing various tasks running in different windows — including the XFree86 GUI.

If you want to write a device driver, it is reasonably simple. In DOS or Windows, it's quite obscure. Sure, in Linux you need to know a little, but you just use the standard compiler and that's it.

All the source code for Linux is openly available. You can see what it is doing, and change it if necessary. The same cannot be said of Windows.

Further, there is an active support network for Linux. There are many Internet Relay Chat servers across the 'net who help any Linux users with problems. There are also newsgroups.

Of course, there are newsgroups and free support available for other operating systems. The difference is that Linux users are more passionate, and committed to helping wherever they can.

The Linux operating system was written in C. So, if you're thinking of doing any hacking into the operating system, you need to learn C. It's also useful in understanding the Linux OS.

However, applications can be written in any supported language. There are compilers/interpreters for TCL/TK, Java, Python, Perl, Fortran, Pascal and many others, as well as the script languages.

But even if you do not write any applications or hack into the kernel, you can use applications which are available in the public domain. There are an enormous number of these — programs to play chess, manipulate files, run CD players and so on. And they are all free — and easier to get hold of, too.

Linux was designed for network compatibility from the start, and is easy to configure into a network. Those file permissions I spoke about earlier become very helpful.

Has its own GUI

Linux has its own 'windows' environment, called 'XFree86', which lets you manipulate images and so on. XFree86 was designed with client/server network connections in mind, and it is much easier to configure a network graphically than in competing operating systems.

XFree86 is cheaper and more efficient (in some areas) than a Windows environment. There is a version of Netscape for XFree86.

Linux was used by the company Digital Domain to generate special effects for the movies *Dante's Peak* and *Titanic*, something which involved networking a lot of computers together to get the necessary grunt. Digital Domain looked at the options available — Windows NT, DEC Unix and Linux — and decided on Linux as the best OS for their needs. (A web article on this is at **http://www.ssc.com/lj/issue46/2494.html**)

The bottom line

Is Linux the operating system for you? Ultimately it comes down to this question: what do you want to do? If all you do is use a computer for word processing, then DOS/Windows may be what you want. But if you develop programs, Linux is a much more friendly place to do it. There are many applications where Linux is cheaper or more flexible compared with DOS/Windows.

So, if you want a Linux system, what is involved? It uses a different disk format, and it is necessary to format a partition specifically for Linux and load the Linux programs into it, normally from a CD-ROM. You then run a special program from DOS to enter Linux.

(If you do not wish to do this, you can run Linux from files loaded into DOS — however, it does run more slowly.)

To install a minimum Linux system, you could get away with 120MB of disk space, but it does depend on what you'll do with it. 200 - 300MB is a good amount to set aside if you can manage, while 500MB is even better.

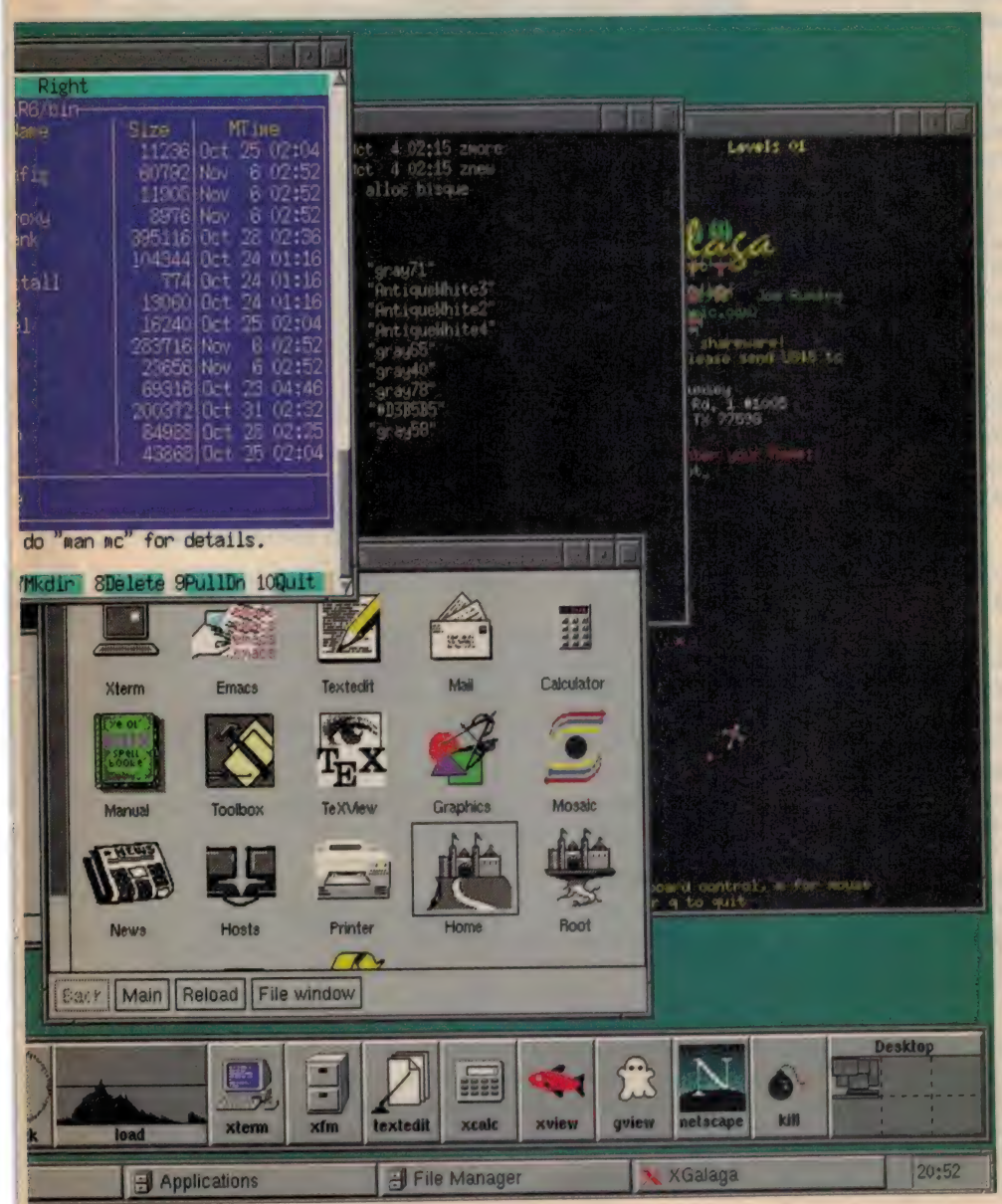
Linux is free; you can pick up all you want over the 'net, and download it. But you'd be waiting forever, and CD-ROMs having Linux (distributions) are normally the way to go. Distributions include Slackware, Red Hat and Debian.

When you hold such a CD set in your hands, you can feel the huge amount of effort which put it together — with hackers all over the world contributing their bit. It is an awesome thing to feel, something that towers above you and threatens to swallow you up...

I have heard the call, and am doing my best for Linux. Writing this article is my contribution for the moment. I *have* been converted to Linux!

For further information about Linux on the web, see Linux Australia's web site at **http://www.linux.org.au**.

The assistance of Sydney Linux Users Group members in developing this article is gratefully acknowledged. ❖



Red Hat Linux 5.0

Feeling worn down by three years of Windows 95? Or perhaps you'd like a new operating system for your PC that *doesn't* make Microsoft even richer? Sound enticing? Well, Linux has been around for several years now, and the new version 5.0 from Red Hat software might just fit the bill...

by JEAN-BAPTISTE CATTLEY

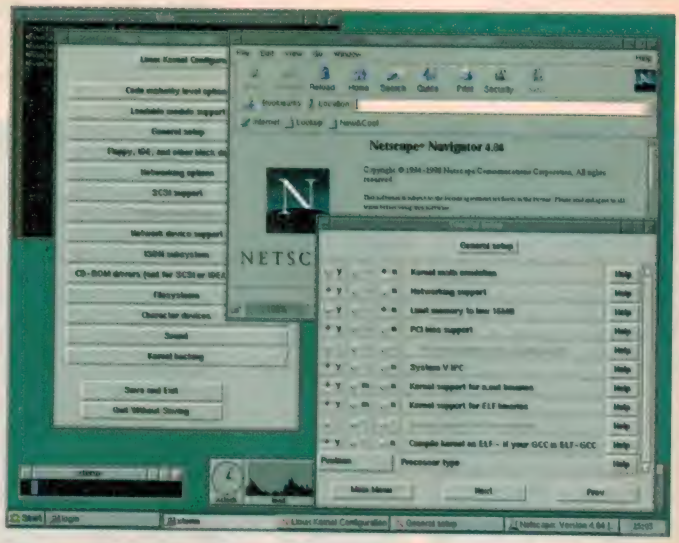
The first the world ever knew of Linux was a post to comp.os.minix in mid 1991, from a student named Linus Torvalds:

Hello everybody out there using minix — I'm doing a (free) operating system (just a hobby, won't be big and professional like gnu) for 386 (486) AT clones...

Since then, Linus' creation has grown to become one of the most popular PC-based UNIX operating systems in the world.

One of Linux's main attractions is that it is essentially free. Anyone can download the necessary files off the net and set up their own Linux system. Unfortunately, downloading hundreds of megabytes of assorted files is no mean feat, and keeping track of exactly which files go where would be beyond the reach of most people. This is where the various third-party distributions come in. Red Hat software have gathered together all the files and utilities needed to install Linux, and put them all on CD, making installation virtually painless.

Unlike some other distributions of Linux, which are aimed more at the kind of people who debug core dumps in their head, Red Hat Linux is well known for its comprehensive and friendly installation package. For this reason, Red Hat is probably the best starting place for people unused to the intricacies of installing a UNIX-style operating system — holding your hand throughout the whole scary procedure.



Here you can see the latest version of Netscape running under Linux (it comes free with the Red Hat distribution), along with some of the Linux setup and configuration managers. A simple terminal program (Xterm) is also running in the lower left hand corner.

Taking the plunge

Even with all the help that Red Hat provides, installing Linux is a major operation and will change your life quite dramatically. Sort of like going out and buying a pet alligator.

The first thing you need to do is to repartition your hard drive with special Linux partitioning software. This means, of course, that everything on your current drive has to be backed up or moved. This can be a major undertaking in itself, so when I installed Linux on my system, I cheated. Instead of dumping my whole 2GB Win95 system onto floppies, I found a spare 1GB drive and used that instead.

Of course you don't need a whole gigabyte to install Linux; you can get away with as little as 40MB if you have to, but 300MB is recommended if you want to install any decent applications, and I would personally recommend a minimum of 500MB, just to be comfortable. While we're on the subject of system requirements, remember that Linux was originally designed for 386 systems, and will take full advantage of anything from a lowly 386SX up to the latest Pentium Pro (with a minimum of 8MB of RAM).

The Red Hat Linux 5.0 package consists of two CDs, two boot floppies and a 320-page manual. Having experienced the CD-ROM driver fiasco with Windows 95, I was not looking forward to getting the system up and running without any operating system to start with. Flipping through the manual, however, I discovered that the CD itself was bootable! This means that if you have a decent BIOS, you can put the CD in and boot off it just like a floppy, which is exactly what I did. How civilised!

Once the setup program started, it launched Disk Druid, Red Hat's special drive partitioning utility for Linux. This got a bit complicated, as the section in the manual explaining the sizes and types of partitions required was nowhere near the section that explained how to drive the partitioning software itself. Once I had that sorted, though, the rest of the installation was perfectly straightforward, although the component selection screen was a bit terse, taking for granted that I knew exactly what packages to install.

Up & running

Well, now I had a full Linux system sitting on my machine. Now what? After booting the new OS and entering your password (always required), you are dumped at the prompt, much like a DOS system. Hopping around all the directories reveals thousands of strangely named files, but no obvious place to start. Much mention is made on the box of the included X-windows GUI, but nowhere in Red Hat's manual does it explain how to start it, or what to do with it once you do. This is not really their problem, as the manual only calls itself an installation and configuration guide. But it would leave a UNIX newbie rather at a loss...

Red Hat do indeed recommend that new users get a good book on

Linux, and I heartily agree with them. But all the same, some kind of 'Neat stuff you can do' section would have improved things no end.

Mind you, being written for and designed by hackers, Linux itself is not for the timid. If you can't bring yourself to hand edit config files and do terrible things to your boot sector, it may not be the OS for you. For example, once you get your system up and running, you are encouraged to recompile the kernel to suit your hardware!

This is made possible by the fact that full source code is supplied, for both the operating system itself and for all the non-commercial software supplied in the distribution.

Anyway, after poking around a bit, I discovered Midnight Commander, a freeware clone of Norton Commander, which made exploring the system an awful lot easier.

Maximum RPM

Unlike DOS/Windows installations, Red Hat Linux comes with such an incredible quantity of applications, utilities and miscellaneous programs that you could use the system for weeks and not run out of new software to try out. Managing this embarrassment of riches could get chaotic, to say the least, if it weren't for RPM, the Red Hat Package Manager. RPM is a nifty little utility that manages the installation, removal, maintenance and upgrading of all the software on your system. A bit like the Add/Remove Software wizard in Win95, except that it really works...

As well as correctly installing and removing software packages, RPM can do other amazing things that leave InstallShield in the dust. For instance, if you don't know what a particular file on your system does, RPM can tell you which package it belongs to, and show you the README that came with it. If you think you may have deleted something vital, it can check that all files for a package exist, and replace any that are missing. Add to this the capacity for differential upgrades and sourcecode management, and you have a really professional tool that takes the edge off the wild anarchy of Linux while keeping its flexibility undiminished.

X marks the spot

One of the other main features of Linux is the X-windows GUI, a strange beast that takes a little explaining. Although on the surface it looks a bit like Win95, it's really only a *window server* that handles the graphics subsystem. All of the fancy features such as file managers and icons are handled by other *window managers* that run under X.

This sounds a bit involved, but it means that if you don't like your current user interface, you can simply use a different window manager to give you a completely different 'look and feel'.

The default setup was a bit like a cross between Win95 and good old Amiga Workbench, with an oddly 'thin' feel to it. Fun to use, but I soon started to miss things like 'Send to' and 'Add to Zip'. Still, it *is* free, so I can't complain too much. Of course, if any Linux program gets annoying, the full source is sitting on the CD just waiting for you to recompile it...

Compatibility

As most of Linux is written for free by people all over the world, hardware drivers tend to get written rather haphazardly, usually by the people who happen to need them at the time. This means that while your average PC will work with Linux straight out of the box, any of the less popular components such as obscure scanners or old network cards might cause a few problems. Soundcards can be a bit of a problem, too. This is alluded to on the box, so if you have a 'Frankenstein' system, you're best off checking out Red Hat's website before committing yourself. (It's at **http://www.redhat.com**)

On the brighter side, there is native support for all kinds of file systems, so you can access your DOS/Win95/OS2 hard and floppy drives with no problems. This also leads to some other interesting possibilities, such as running a dual-boot system.

After a little hacking, I was able to put my original drive back into my system, and configure the bootloader to boot straight into my unmodified Win95 system by default, with the option to load Linux instead. This means that you don't have to sacrifice your current setup to try it out.

Summing up

Linux is decidedly impenetrable to the new user, but with a bit of experience it quickly reveals its insanely powerful nature. Contrast this with DOS, where you can grasp the basic operations almost immediately, but only slowly come to realise all the things you *can't* do with it.

Red Hat's distribution comes with a whole raft of applications to get you started, including the Apache web server — as used on over half a million commercial web servers around the world.

Whatever you want to do, from running your own web server to playing NetHack, you can do it with Linux. And since you can get it for less than the price of the latest version of Quake, you really don't have an excuse not to at least try a Real Operating System. ❖

Red Hat Linux 5.0

Good points: *Comprehensive package with an easy setup and excellent package manager.*
Bad points: *Manual only covers installation — could do with more 'getting started' info.*
RRP: *$59.00.*
Available: *NetCraft Australia, PO Box 390, Blackwood SA 5051; Phone (08) 8370 3650, Fax (08) 8278 8325. Web site: http://www.netcraft.com.au/redhat/*

Computer

News & New Products

Deskjet offers large format, photo quality

Hewlett-Packard's new HP Deskjet 1120C Professional Series inkjet printers are said to offer versatile photo-quality business printing, exceptional media flexibility, enhanced software features and network options. The printers replace the HP Deskjet 1000C series printers, HP's first Deskjet printers to print on A3-size paper. The new printers have an estimated street price including sales tax of $949.

The new printers use HP-developed PhotoREt II technology to deliver the highest-quality output offered in Professional Series Deskjet printers. They are claimed to use the smallest ink drops in the desktop-inkjet-printer category, to deliver less-visible dots; more shades of colour for clear, vibrant, natural-looking results; sharp, professional-quality black and colour with HP-developed inks; and superior results on all office paper, plus 'outstanding' results on special paper. These benefits are delivered through the new HP colour cartridge, first introduced with the HP Deskjet 890C printer.

The HP 1120C printers provide support for Microsoft Windows NT 4.0, Windows 95, Windows 3.1x and DOS. They use HP PCL 3 printer control language, and can be shared among several users by attaching them to networks using HP JetDirect external print servers. Throughput is up to 6.5 pages per minute (ppm) for black text and 4.5ppm for colour.

For more information circle **160** on the reader service card or call HP Australia on 131 347 (toll free).

Hitachi CD-ROM drive runs at 32X

Hitachi Australia claims its latest computer CD-ROM drive offers the highest speed, data transfer rate and access time, on the market. The Hitachi CDR-8430 employs full constant angular velocity (CAV) drive technology, offering speeds up to 32x depending on data position on the disk.

Maximum sustained data transfer rate is 4800k bytes/s, with a burst rate of 16.6MB/s using either PIO or DMA mode, via an Enhanced IDE Interface (ATAPI). Access time reaches a new low of 80ms at 1/3 stroke. Hitachi claims these new performance figures ensure that even full-screen, full motion video sequences are viewable at maximum quality.

To cope with these higher transfer speeds and mechanical stresses (the disk rotates at 7490rpm versus 5500 on an older 24x model), the new drive incorporates a unique Hitachi designed anti-vibration mechanism. The 'ball-balancer' technology assures smooth, reliable operation and extended durability; MTBF for the new drive is now quoted at 125,000 hours, or a 25% improvement over the superseded 24x drive.

The new drive is also compatible with a wide range of existing CD media such as CD-Extra, CD-R and CD-RW, ensuring maximum versatility. It is available at an RRP of $199 (ex tax).

For more information circle **161** on the reader service card or contact Hitachi Australia, 13-15 Lyonpark Road, North Ryde 2113.

PCI DAQ boards offer many channels

National Instruments has announced four new PCI data acquisition (DAQ) boards, featuring E-Series technology and bus mastering for high throughput across the PCI bus. The company also announced the SCC Series analog signal conditioning components for use with 68-pin E Series DAQ boards.

The PCI-6071E is a 12-bit, 1.25MS/s multifunction plug-in board with 64 analog input channels and two 12-bit analog output channels. The PCI-6031E, PCI-6032E, and PCI-6033E are 16-bit, 100kS/s

plug-in boards with 64, 16, and 64 channels respectively — the PCI-6031E also features two 16-bit analog output channels. Common to all boards are two 24-bit, 20MHz counter-timers, eight digital I/O

lines, and analog and digital triggering. All feature a shielded latching metal connector.

These four offerings bring the total number of E-Series interfaces to 25, including plug-in boards for PCI and ISA, PCMCIA cards, external devices and VXI modules. All include NI-DAQ driver software and are compatible with LabVIEW, LabWindows/CVI, Measure, BridgeVIEW, ComponentWorks and VirtualBench virtual instrumentation software.

For more information circle **163** on the reader service card or contact National Instruments Australia, PO Box 466, Ringwood 3134.

'Virtual lab' for comms training

LVSIM-COM from Lab-Volt is a Windows-based simulation program for training in analog communications. The software contains all modules and covers all of the courseware and experiments offered by Lab-Volt's hardware-based 8080 training system, plus virtual laboratory instruments and data acquisition.

With LVSIM-COM, all of the standard analog communications laboratory equipment is replaced by images of modules that students can manipulate on the computer screen. Using the mouse, students can identify and set up equipment for a given exercise, make the necessary connections between modules and verify the connections without touching a physical module.

Sophisticated mathematical models accurately simulate the electrical characteristics of all the physical modules: an AM/DSB/SSB Generator, AM/DSB Receiver, SSB Receiver, Direct FM Multiplex Generator, Indirect FM/PM Generator, and FM/PM Receiver.

LVSIM-COM includes Data Acquisition and Management Software which is a full instrumentation package, including Oscilloscope, Spectrum Analyser, Frequency Counter and True RMS Voltmeter. Data can be logged in a data table (ASCII format) for data analysis, and

students can plot graphs using data recorded in the data table.

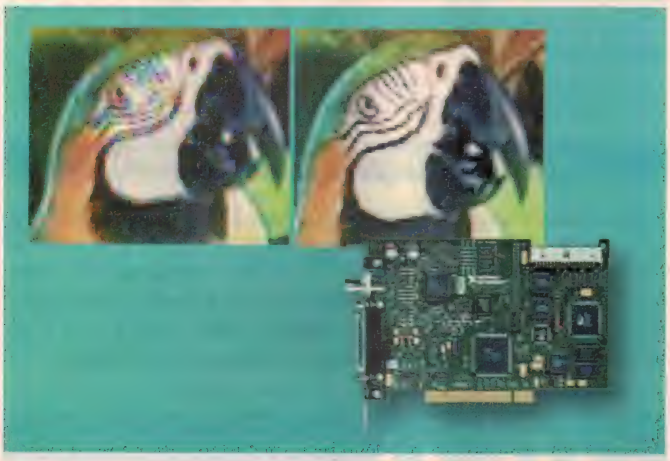
For more information circle **164** on the reader service card or contact Lab-Volt, PO Box 289, Ingleburn 2565.

Low-cost colour image acquisition

National Instruments has announced a new software technology that system developers can use to acquire high-resolution 24-bit colour images from video, using inexpensive 8-bit image acquisition hardware — traditionally, hardware that was solely used for gray scale image capture. The new algorithm, labelled 'StillColor', is now available in the National Instruments image acquisition driver software that

is included free of charge with the company's image acquisition hardware. As a result developers in biomedical image processing and machine vision technologies can use StillColor to acquire crisper, higher quality images at a rate up to 10fps. StillColor software works with standard video formats such as NTSC, PAL and RGB.

NI-IMAQ driver software for gray scale and StillColor image acquisition gives users comprehensive access to the functionality of the IMAQ PCI-1408 board. The driver includes functions for single and sequential image capture, triggering and storage. The IMAQ PCI-1408 is a high-quality image acquisition board for the PCI bus. This grayscale and StillColor 8-bit board accepts signals from a variety of cameras at rates up to 20MS/s. It uses the custom MITE ASIC to provide high speed data transfers to non-contiguous RAM at full PCI bandwidth.



For more information circle **165** on the reader service card or contact National Instruments Australia, PO Box 466, Ringwood 3134.

Pro-quality PC audio recording

Frontier Design Group has produced a family of products which allow a PC to be converted into a powerful yet affordable digital audio workstation, with full professional 20-bit A/D and D/A performance. The WaveCenter multichannel digital audio and MIDI I/O card integrates ADAT optical, SPDIF and MIDI on a single card, providing a full complement of the most popular digital audio interfaces, while the external Zulu and Tango units provide either 4X8 or 8X8 external 20-bit A/D and D/A converter channels, which interface with the WaveCenter via the ADAT optical format.

The WaveCenter card accepts eight channels of optical digital audio via the ADAT input, two channels via the SPDIF optical input or two via the SPDIF electrical input or internal CD-ROM cable. Similarly it provides 10 independent output channels via the ADAT optical and SPDIF electrical outputs, or four via the SPDIF optical and SPDIF electrical. It also provides one MIDI input and three independent MIDI outputs via a molded breakout cable. Sample rates are 44.1 and 48kHz internal, with varispeed following inputs from 39 - 51kHz. The card supports the most popular and respected multichannel digital audio and MIDI applications running on the Windows 95 and NT platforms.

Both the Zulu and Tango converters feature 20-bit delta-sigma conversion, with a frequency response from 20Hz - 20kHz +/-0.1dB,

a S/N ratio greater than 98dB (dynamic range >98dB A-weighted) and THD + N <0.002% A-weighted. Separate power transformers together with the optical interfaces to the WaveCenter card eliminate the possibility of hum loops.

The Zulu is a half-rack unit providing four analog inputs and eight analog outputs, at -10dBV levels via pro-grade 6.5mm jacks. It provides analog level indicators for the four analog inputs.

The larger Tango is a modular 1U rack unit providing eight outputs and accepts either zero, four or eight inputs, via upgrade kits. Each channel operates at either +4dBV or -10dBV selectable, and all audio connections are balanced via professional 6.5mm tip-ring-sleeve jacks. It operates at internal sampling rates of 44.1 or 48kHz but also accepts external clocks. The eight level meters are switchable between inputs and outputs.

For more information circle **166** on the reader service card or contact Moore Music, 219 Napier Street, Fitzroy 3065. ❖

Webwatch

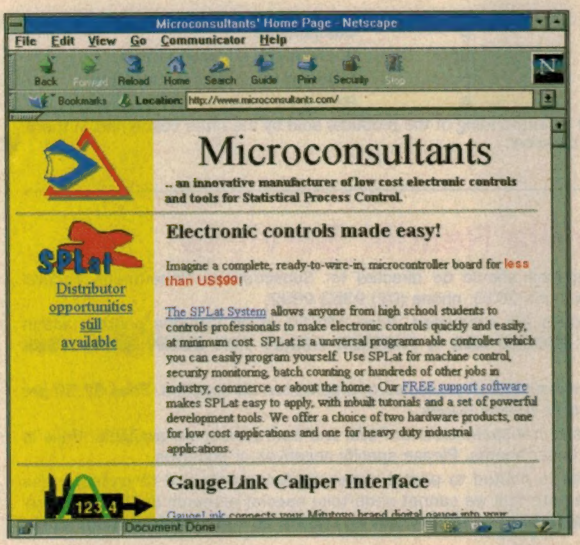
by Graham Cattley

Yes, it's a new look to Webwatch as well. Looking back over the last 12 months of this column (is it a year already?) I realised that I'd passed over many of the smaller or more specialised sites in favour of the larger, flashier ones. I think that this new format will let me cover more sites per issue, and so give everyone a fair go. (Of course I only have room for four sites this month, but I promise not to rabbit on so much in the future.)

Catch up on the maths

I'll start off with the University of Guelph (in Ontario). This has an excellent tutorial on the more mathematical side of electronics, with individual pages covering everything from Ohm's law, through resistors in various configurations up to superposition and Thevenin's Theorem, as used in circuit analysis.

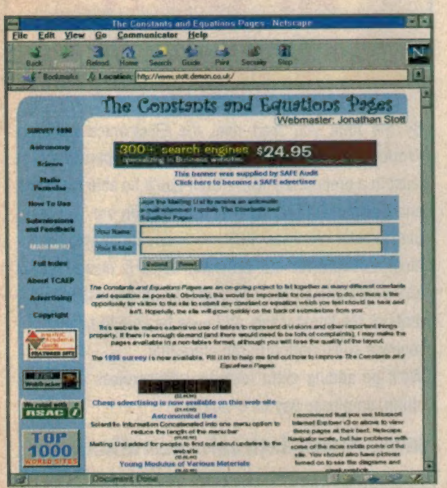
They've provided some example problems, along with a self-test to see how you're going. It's one of the more comprehensive tutorials I've seen, and you can find it at **http://www.physics.uoguelph.ca/tutorials/tutorials.html/**. If you are feeling ambitious, you can head off to their home page and try some of the other tutorials on physics that they offer as well.



Constants and Equations

Of course you'll have forgotten Wien's law by now, so hop on over to **http://www.stott.demon.co.uk/**, where Jonathan Stott has set up The Constants and Equations Pages. Here you'll find lists of all the equations, mathematical and planetary constants, indices, and coefficients you could ever need, and many more you won't...

Everything is grouped quite intelligently into science, maths, and astronomy, with each section containing data on other points of interest; the Periodic table of elements in the science category for example. (This table is very well executed by the way, but you'll need a fairly recent browser to see it in all its glory). Speaking of browsers, Netscape doesn't support the Latin character set, which makes things difficult to say the least — but IE3 and IE4 users should be OK.



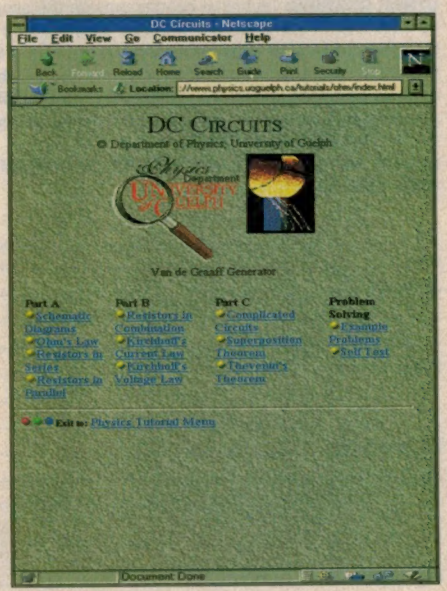
Work of art

Arn Roatcap offer a few notes on stepped attenuators on their site at **http://www.slip.net/~arinc/intro.html**. Stepped attenuators offer many advantages over your common potentiometers, but there are various different switching configurations, each with their own pros and cons as you'll see here. Be sure to take a look at the 'Big Picture' of one of their attenuators — its a work of art and has ousted Claudia as my Windows wallpaper. Well, for now anyway.

Microconsultants

Microconsultants are the people who brought you the SPLat microcontroller, and they have quite a decent site that covers a lot more than just info on their products. There are several articles on such diverse subjects as automobile detection, calculating CRC (Cyclic Redundancy Codes), and a very good one on power factor which explains why $cos(\phi)$ isn't always the right answer.

You can download the full version of their SPLat/PC development software, which contains a good tutorial on microcontroller programming, as well as the simulator itself. There's other demo software available as well, so if you wouldn't know a state diagram from a ball of string, go and have a look at **http://www.microconsultants.com/index.htm**, and learn a lot.



I'll finish off by saying that I welcome any input to this column, and so if you know of any deserving sites that could do with a mention, feel free to send me an email. Our address is **electaus@magna.com.au**, or send them to me directly at **grahamc@hannan.com.au** and I'll be happy to include them in an upcoming issue.❖

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AT LAST! EA's Web Site

By the time you read this, the Electronics Australia World Wide Web Site should finally be operational, at least in a preliminary form. On it you'll be able to access and download all of the files available on our very popular Reader Services BBS — including project index files, software for our projects, notes & errata, useful shareware and so on. You'll also be able to see the contents of the latest issue, and even be able to take out or renew a subscription to the magazine.

We'll be adding extra features and services as we go along, so please pay us a visit at:

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The best "value for money" CCD camera on the market! Tiny CCD camera, 0.1 lux, IR responsive, high resolution. It has a metal lens housing and glass lenses, & performs better than many cheaper models.

WITH YOUR CHOICE OF ONE OF THE FOLLOWING LENS
Pinhole (60deg.), 78 deg.; 92 deg.; 120 deg.; $89 or $99 with a 150 deg.

CASE AND SWIVEL
A small plastic case suitable for enclosing the CCD camera, plus a very strong multi angle and position adjustable universal joint swivel bracket plus screws, suitable for stereo speakers etc.: $4

UHF A-V MODULATOR
Professional stable design PLL, tuneable UHF A/V modulator with built in Antenna booster and a test pattern generator: As used in VCR's. Inc. parts for a 5V regulator $18

UHF A-V TRANSMITTER
Send video to TVs in your home. Inc. Stylish case telescopic antenna & leads: $35 (G01)

AUDIO PREAMPLIFIER
Small kit which includes a microphone. Gives Line level output for use with the above Modulator or transmitter: $6

AUDIO POWER AMPLIFIER KIT
A small LM386 based power amplifier kit that can directly drive a speaker, needs the above Preamplifier: $8 (K64)

TIME LAPSE RECORDING INTERFACE
New kit, now has relay contact outputs! Can be directly connected to a VCR or via a learning remote control: $35
PIR MOVEMENT DETECTOR module to suit above kit, very small: $16

LED IR ILLUMINATORS KITS
10 LED: $14 - $10, 30 LED: $30 -$20

HIGH RESOLUTION MONITOR
Brand new 240V 30cm enclosed computer monitor + a video conversion kit. Gives better resolution than TV's!! Avail. early Feb. Limited but good qty. **BARGAIN PRICE.**

MINIATURE FM TRANSMITTER
(33 x 23 x 10mm) enclosed in a small black metal case. Built in switch & microphone. Specifications: 88 to 108-MHz (adjustable), has a wire ant. attached, bat. life 60 hrs, Range 50M: $39 (Std. watch battery LR44, inc.)

***** SPECIAL *****
MASTHEAD AMPLIFIER KIT
Our famous MAR-6 based masthead amp. Up to 2Ghz. 2 section PCB (power supply section. can be indoors): Kit includes Plugpack: and 2 Weatherproof boxes: $24. (MAR-6 avail. separately)

DOG SILENCER NEW IMPROVED KIT
High power swept ultrasonic generator kit that can drive up to 4 piezo tweeters. Works on dogs & most animals. PCB & all on-board components and horn piezo tweeter: $33, extra tweeters $7 ea. Suitable 13.8V-1A DC plugpack $10.

COMMAND CONTROL FOR MODEL TRAINS. Control up to 16 trains on one layout with very little wiring!: As per SC. Jan-May 98. We have some hard to get ZN409CE IC's. We will also be supply silk screened, solder masked PCB's & special parts for this kit. at good prices!!

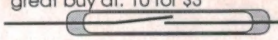
NETWORK 2 PCs FOR $30!! New Win/95 compatible (DEC (DE101) etherworks LC/TP) DIGITAL brand Ethernet PC. cards, software and booklet in original box. Cards inc. boot ROM so one of the PCs does not even require a hard disc. We dont supply the commonly available PC. cable which can also be made up with RJ45 connectors and two twisted wire pairs: Diagram included. We have a quantity of these with soiled boxes, Clearance:$30 pair

UNIVERSAL SWIVEL BRACKET
Very strong!!! Heavy duty!!! Will rotate 360deg. & tilt 180deg: 10 for $15

COMMUNICATIONS SPEAKERS
High quality robust fully enclosed speakers with swivel bracket, 80X60X65mm, 0.2 Kg, with 1.5M lead & 3mm plug: $4

LIGHT MOTION DETECTORS: Small PCB assy. with ULN2232 IC. Device has built in light detector, filters, timer, narrow ang. lens, and a siren driver to drive a speaker. Detects movement across a narrow corridor up to 2.5 metres away, better range in darkness is possible if the detector is illuminated by a visible light or IR LED. Full information provided. The IC normally costs $16! : (G07) $6

REED SWITCHES NEW!!! Quality "Bell telephone" brand 28mm x 3.5mm. A great buy at: 10 for $3



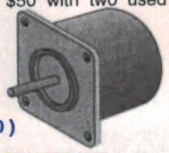
60 SECOND SOUND RECORDER. IC, Contains all the control circuitry, AGC, power amplifier, A-D/D-A converters and even a 256K Flash EPROM: Complete good quality 60 Sec. digital rec. IC that even has random / sequential access of fixed/ variable length messages. Only requires a few passive components, an electret mic. & a spkr. Special introductory price: $23

MID RANGE SPEAKERS
100mm, 8ohm, 3W quality mid range speakers. A bargain at: 10 FOR $10

FIBER OPTIC CABLE (COMS GRADE)
approx. 0.6mm diam. $1 per meter

DIGITAL BAR CODE WANDS: New USA made wands fitted with 2.5m long curly cord terminated in a 5pin 240° DIN plug. Contain an optical sensor, visible red LED, a photo IC detector and precision aspheric optics. Converts bar codes into a digital pulse train as it is manually swept across the bar code. Employs a Sapphire tip, pot size is 0.19mm. Output is open collector TTL/CMOS compatible and the wand is needs to be powered from 5V: (G61) $30

****** TWO GREAT SPECIALS ******
*****STEPPER MOTOR DRIVER KITS*****
NEW!!! COMPUTER CONTROLLED STEPPER MOTOR KIT New improved kit that can drive larger motors and has optoisolation between the circuit and the computer. DB25 connector provided on PCB. Needs a standard DB25 cable for connection to a PC, and a power supply for the motor drive section. PCB and all on board components kit plus software and notes: $40 or $50 with two used 1.8deg. motors !!!



(ONE ONLY NEW MOTOR OF SIMILAR QUALITY TO THE ONE SUPPLIED COSTS OVER $100)

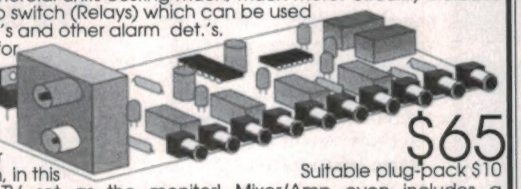
STEPPER MOTOR DRIVER KIT
Kit includes a large used 1.8deg. (200 step / rev) motor & uses SAA1042A IC. **(ONE OF THESE CHIPS WOULD RETAIL FOR ALMOST $19)** Can be driven by external or an on-board clock; has a variable frequency clock generator. Ext switches (not inc) or logic levels from a computer etc set CW or CCW rotation, half or full step operation, operation enable/disable, clock speed. PCB and onboard components:$20 with 1 motor, $30 with 2 motors.

LASER POINTER KIT SPECIAL!!!
650nM 5mW, 3-4V, case 125 x 39 x 25mm, lens, battery holder NOW JUST: $25

AUTOMATIC LASER LIGHT SHOW KIT
The changes every 5-60 sec, adjustable. Countless displays single to multiple flowers, collapsing circles, rotating single & multi ellipses, stars, etc. PCB + all PCB components, three motors & mirrors : $65 Or with above kit for $79!!

KIT OF THE MONTH

Professional quality 2/3/4 ch. (selectable) sequential A/V switcher: Yes you can have up to 4 cameras and up to 4 microphone inputs! Uses relay switches to produce much better bandwidth / picture quality than is possible with C'MOS IC's. Has many more features and is of better quality than many commercial units costing much, much more. Circuitry includes a VCR Rec. / Stop switch (Relays) which can be used with standard PIR's and other alarm det.'s. Has A/V outputs for a monitor, optional UHF A/V mixer amp. can be inc. Add a security channel into your existing TV system, in this case use your TV set as the monitor! Mixer/Amp even includes a switchable test pattern generator for easy tuning. Low cost, PCB and all onboard components kit!: $65...$18 Extra for the UHF mixer/amp..



Suitable plug-pack $10

NEXT MONTH - LONG RANGE UHF REMOTE.
A 2 channel high security UHF remote control with 12A relay contacts. Can be set for momentary or toggle operation. The combination of a higher power SAW resonator locked transmitter (433.9MHz) and a very sensitive preassembled superhetrodyne UHF Rx module gives a range of up to 1KM!!: Approx. $75 for one Tx. and one Rx.+ 1 Rx.)

MAGNETS: HIGH POWER NEO-DYMIUM RARE EARTH MAGNETS: Very strong You will not be able to separate two of these by pulling them apart directly away from each other. Zinc coated.---CYLINDRICAL 7 mm diameter x 3 mm thick: (G37) $2.50.---CYLINDRICAL 10mm diameter x 3 mm thick: (G38) $5.---TOROIDAL 50mm outer, 35mm inner, 5mm thick: (G39) $12.---ROD 10mm long, 4mm diameter: (G54) $2.50.---CYLINDRICAL 3mm diameter x1.5mm thick: (G58) 2 for $1

CGA COLOUR MONITOR.... NEW 12V
DC-1A 6" colour monitor, ready for enclosing, no box, just the tube and driver PCB's Down from $69 now just $40

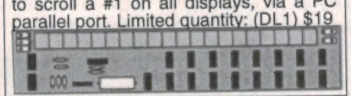
DC MOTOR SPEED CONTROL EXPERIMENTERS PACK
ONE 20A motor speed controller kit (similar to SC - Jun.97-$18) plus two small new 12VDC motors (40mm dia., 40mm length) plus one used car windscreen wiper motor (which have internal gear reduction) for: $32

OPTICAL TACHOMETER KIT
Measures RPM of prop. shafts etc. without physical contact. similar to the kit published in SC. (May 1988), but includes X-tal control calibrator. Use a DMM on 200mV or a 3 1/2 digit panel meter as the display PCB + all on-board components: $25.

******SPECIAL***SPECIAL***SPECIAL*****
ELECTRONIC KEY KIT:
An AX5326 IC + other parts on a small PCB, When touched against the decoder terminals, switches on-board 12A N/O-N/C relays. One momentary relay for car indicators or buzzer etc. The other can toggle or momentarily switch electric door strikers, car alarms, central locking, Many high security uses. Has no key battery, it's power is derived from the decoder. It's **IMPOSSIBLE** to determine code from decoder terminals, Safer than keypad locks. Over 500,000 personalised codes. 10-15V. RX PCB: 140 x 66mm. "Key" PCB is 50 x 30mm. Kit With 2 keys:$30

SOLID STATE 4-6A PELTIER EFFECT COOLER / HEATER 3.3A@14V PELTIER: $27, 6A @15VPeltier: $35, both are approx. 40X40X4mm, can be temperature controlled by reducing supply voltage/current, will even work from a 1.5V battery!! We supply Peltier Effect device, data sheet, diagram & circuit for a small fridge / heater.. Other requirements; Insulated box, 2 large heatsinks, & a small aluminium block. This device is used in the common 15Lr car fridge. Peltier effect Device + (G02) 12V DC Fan:(G11)

MOVING MESSAGE DISPLAY PCB: Used, complete assy. 20 bright 5x7 matrix LED displays (**700 LEDs.**) and driver. Inc. 20 x 74HC164 ICs. Display size is 280 x 18mm LED's, PCB 330 x 75mm. Req. ext.l 5V supply. Inc. a sample program on disk & instructions to scroll a #1 on all displays, via a PC parallel port. Limited quantity: (DL1) $19



***** SPECIAL *****
GRAB THEM BEFORE THEY GO!!!
STILL THE BEST LASER LIGHT FOR HOLIGRAPHY ETC. HELIUM - NEON LASER TUBE & POTTED SUPPLY: Large 2-3mW laser head + compact potted US made power supply. Head plugs into the supply & connects to 240Vac.. Bargain: $65 **WARNING!!! VERY BRIGHT NOT FOR USE BY CHILDREN!!! ALL LASERS MUST BE USED UNDER COMPETENT SUPERVISION.**

MORE KITS
Geiger counter:$40,...Breath tester: $40, Music box: $11,..Ding dong doorbell $3.50,...Siren using a 10cm speaker: $14,..Electric fence using used car coil: $25,..Ultrasonic car alarm: $35,..1ch UHF Central locking, Tx and Rx: $35,...4 door Central locking: $60,..2 Channel UHF Remote Control 1Tx + 1Rx: $45.

STEREO FM TRANSMITTER KIT: 88-108MHz, 6-12V DC, 8mA @ 9V, 25 x 65mm PCB size, PCB plus all on-board components, plus battery connector and 2 electret microphones. (K94) $25

12V/7Ah GEL BATTERY BARGAIN
Fresh stock NEW standard battery plus **1 NEW INTELLIGENT GEL / LEAD-ACID BATTERY CHARGER for: $30**

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major cards with ph. & fax orders,
Post & Pack typically $6

Where do you GO for the last word in electronics...

T2 Electrical Tester

There are no settings on this voltage and continuity tester. Simply probe a circuit to see whether you're looking at AC Volts, DC Volts, or an open circuit. You don't even have to turn it on or off! Designed to work long and hard, this voltage and continuity tester is a new release from Fluke.

Q 1627

FLUKE

$99 NEW

Three-in-One T5-600 Electrical Tester

The Fluke T5 Electrical Tester lets you check voltage, continuity and current with one compact tool. All you do is select Volts, Ohms or Current and the tester does the rest. OpenJaw current lets you check current up to 100A without breaking the circuit.

Q 1628

FLUKE

$179 NEW

Multi-Purpose Multimeter Fluke 12B Multimeter

Automatic selection (V-Chek) of V AC, V DC, Ohms and continuity. Low impedance input eliminates reading "ghost voltages" on non-energised circuits. Minimum/maximum recording, with relative time stamp. Continuity capture locates intermittent opens and shorts. Four capacitance ranges and a 3 3/4 (4000 count) display.

Q 1634

ONLY 8 LEFT! at this fantastic price

SAVE $50 **$169*** FLUKE

Fluke Graphical Meter 867B

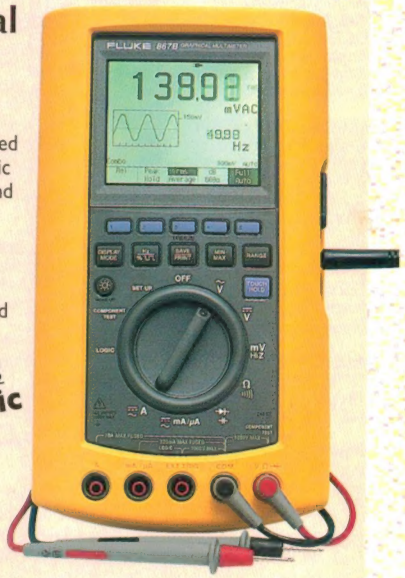
Combines powerful graphic displays with advanced multimeter functions. Enhanced graphical features include logic activity, component testing and waveform capabilities. Measures AC/DC voltage (320mV-1000V) and AC/DC current (320uA to10A), resistance, capacitance, dB and frequency.

Q 1642

ONLY 4 LEFT! at this fantastic price

HOT PRICE!

$1199*



FLUKE

Fluke Scopemeter 99B 100MHz

This dependable, hand-held scope features an easy to read backlit screen, 100MHz bandwidth, 30K memory and 5 gigasamples/second repetitive sampling for higher accuracy. It accesses over 40 commonly-used measurements and connects to a PC or printer.

Q 1646

ONLY 2 LEFT! at this fantastic price

HOT PRICE!

$3950*

FLUKE

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PHONE: 1300 366 644 (Local Call Charge) **FAX:** (02) 9395 1155

MAIL: **DICK SMITH ELECTRONICS,** Direct Link Reply Paid 160, PO Box 321, North Ryde NSW 2113 (No Stamp Required)

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Please add postage (up to 5kg) to your order, as follows:

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